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Canada Agriculture

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Cover photo
Photo de la page couverture

This parasite (the microctonus bicolor) is being studied as a control for flea beetles.

Ce parasite (microctonus bicolor) est présentement à l'étude en tant que moyen de contrôle de l'altise.

Canada Agriculture

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The Canadian Agricultural Outlook Conference

Each year since 1934 an Agricultural Outlook Conference has been hosted in Ottawa by the federal Department of Agriculture.

The initial years of the conference were devoted to providing agricultural outlook information. During the war and the immediate post-war period, emphasis shifted to establishing production goals and objectives. In the 1950s, policy matters, market prospects, and the general agricultural outlook filled the conference agenda. In 1965, policy matters were removed from the agenda and attention was again concentrated wholly on the agricultural outlook.

Recent innovations include opening the conference to other food interests, adding concurrent commodity and farm input group discussions, and in 1978, introducing an outlook for food prices. The meeting has evolved into an agricultural and food conference catering to related interests. Participants now include representatives from governments, farm organizations, agri-business organizations, universities and other agricultural and food interests who meet to review the prospects for agriculture and food in the year ahead. Participants now view the conference as a forum where the various agricultural and food communities may liaise on an annual basis.

Increasing attendance at the Canadian Agricultural Outlook Conference broadens the opportunity for Agriculture Canada staff to present and discuss the latest agricultural and food outlook information with a variety of interested parties, and to promote a sound liaison with other agriculture and food interests.

La conférence sur les perspectives de l'agriculture canadienne

Chaque année, depuis 1934, le ministère fédéral de l'Agriculture tient à Ottawa une conférence sur les perspectives agricoles.

Les premières années, la conférence consistait strictement en une séance d'information sur les perspectives de l'agriculture. Pendant la guerre et la période qui lui fit immédiatement suite, on s'intéressa plutôt à fixer des objectifs globaux et à court terme pour la production. Au cours des années 1950, les questions de politique, les possibilités du marché et les prévisions agricoles générales firent leur apparition sur l'ordre du jour des conférences. En 1965, on a supprimé les questions de politique et mis de nouveau l'accent sur les perspectives agricoles.

Ces dernières années, on a innové en ouvrant la tribune de la conférence à d'autres domaines de l'alimentation, en l'assortissant de discussions en groupes simultanées et en introduisant (1978) les perspectives sur les prix des aliments. On compte maintenant parmi les participants des membres des administrations publiques, des organismes de producteurs et de l'agrinégoce, des universités et des autres milieux agro-alimentaires. Ces gens considèrent maintenant la conférence comme un carrefour où, chaque année, peuvent échanger entre elles les diverses collectivités agro-alimentaires.

Pour le personnel d'Agriculture Canada, l'accroissement du nombre de participants élargit l'éventail des interlocuteurs et lui donne l'occasion d'établir des liens durables avec les divers secteurs représentés.

Top photo. Photo du haut.
Delegates gathered in the main conference room at the 1979 Agricultural Outlook Conference.
Rassemblement des délégués dans la salle de conférence principale durant la Conférence de 1979 sur les perspectives de l'agriculture.

Bottom photo. Photo du bas.
Andre Trempe has coordinated the Outlook Conference for the past 25 years.
M. André Trempe coordonne la Conférence sur les perspectives depuis 25 ans.

André Trempe

The making of a research station

Kenneth R. Clark

Tradition is not trifled with at the Winnipeg Research Station of Agriculture Canada. Reminders of the past as pointers to the future are all around at the collection of buildings on the University of Manitoba campus on Winnipeg's southern outskirts. It's a place that sees its future in its beginnings.

A brass plaque on the wall of the main building outside the front door amounts to a memento of the station's start in 1925. It began as a small lab staffed by a handful of scientists with a mandate for research into plant rust, a disease plaguing prairie farmers at the time. The plaque, bearing the words "Dominion Rust Research Laboratory," was brought to its honored main-entrance position from the first laboratory building (still in use across the road) erected 55 years ago.

One of the many living links to earlier days is Harold (Wally) Wallace, now 73, who retired 8 years ago from his job at the station, but stayed on in an unpaid capacity. Wallace first joined the station in 1938 as a $110-a-month plant disease investigator and has been there ever since, putting his master's degree in plant pathology from the University of Minnesota to good use.

Upstairs from Wallace's basement office, embedded in a wall of the station's library, are the ashes of Prof. A.H. Reginald Buller, one of those who pushed for the establishment of the original rust lab. The mortal remains of Prof. Buller, a noted researcher, author and lecturer (and limerick-writer in his lighter moments*), are surrounded by his extensive book collection which he handed over to the research station for use after his death. The former head of the University of Manitoba botany department died in 1944.

*Buller's most famous limerick dealt obliquely with the question of relativity and was published in Punch, the British humor magazine. It reads:

There was a young lady named Bright,
Whose speed was far faster than light.
She set out one day
In a relative way
And returned home the previous night.

La Station de recherche d'Agriculture Canada à Winnipeg est entrée en activité en 1925 avec pour mandat de développer la résistance des grains aux différentes formes de rouille qui endommageait les cultures dans les Prairies. Depuis longtemps, le problème de la rouille est sous contrôle mais d'autres champs de recherche ont été ajoutés au fil des années. La Station compte à présent plus de 40 spécialistes engagés dans la recherche de meilleures formes de blé et autres céréales, dans le contrôle biologique des insectes et la protection des réserves de grains.

Dr. J.H. Craigie in east laboratory of Dominion Rust Laboratory, 1926.

Dominion Rust Laboratory under construction, 1925.

Professor A.H.R. Buller outside Rust Laboratory, about 1930.

Buller was never on the station's staff, but his life and work were intertwined with it.

With the kind of loyalty and support epitomized by people like Buller and Wallace, the old rust lab grew into a prominent center for research activities linked to the surrounding prairie, but it also held true to its original mandate to develop rust-resistant grain strains. The onus and the challenge continue today and the Winnipeg station remains the predominant institution in Canada in this field. But many other research avenues and traditions have been added through re-organizations and changes in the agriculture department through these 20th century years. Rust remains a threat even though the last major epidemic was 25 years ago. Stem rust in particular is an unremitting opponent with new and more virulent varieties arriving from time to time.

It is this knowledge that helps keep Barrie Campbell, possibly the preeminent wheat breeder in Canada, doing what he has been doing since joining the Winnipeg facility as a summer student in the 40s, a time that gave him personal links with some of the originals of the old rust research lab.

In whole or in part, Campbell has supervised the introduction of seven new wheat varieties including the latest, Columbus, which should be available to farmers in quantity for seeding in 1984 at the latest. The measure of Campbell's accomplishment is recorded best in the bald statement that the great bulk of the bread wheat acreage on the prairies is sown to varieties (principally

Neepawa) that he and his team developed. Neepawa was grown on 61.7 percent of the 23.75 million acres sown to bread wheat on the prairies in 1980.

Neepawa was first distributed to farmers in 1969, the same year that Campbell began applying in earnest the wheat breeder's trademarks of extreme patience, scientific knowledge and good luck to the creation of what came to be known as Columbus, a variety that should appeal to farmers seeking a wheat resistant to sprouting in wet weather after ripening or when lying in the fields.

Columbus is a late-maturer, however, and as such would be more at home in the longer growing seasons of the southern prairies, rather than the north. While the emphasis is on rust resistance in the station's breeding programs, Campbell and the handful of people like him that make up the wheat breeding community in Canada build many other improvements into their creations in the tedious years-long crossing, growing, testing and winnowing process (indoors and outdoors) that precedes the arrival of a new and better variety of plant.

Campbell retires in 8 years, but the station's tradition is such that somebody else will continue his work in the same manner that Campbell picked up the threads more than three decades ago. He came in partway through the process that led to the development of Selkirk wheat, which had much to do with beating back the last great rust epidemic a generation ago.

Campbell is one of 40-odd station researchers whose work is supported by a larger number of technicians, clerical workers, farm laborers and so on. Campbell, middle-aged, with years of experience and the slightly weathered look of a man who spends time outdoors, is typical of the research staff at the station. Their business attracts few superficial fly-by-nights. Agricultural research is as measured and continuing as the prairie growing seasons and so, in general, are those who provide its scientific base.

The common goal for all these people is to develop new and better strains of wheat, oats and barley for the prairie farmer and to find ways to control or eradicate disease and harmful insects from prairie crops in the fields, storage and shipment. Few work alone. Scientific achievement is normally a group effort and a wheat breeder like Campbell calls on experts (entomologists, chemists, geneticists and pathologists) at the station as he needs them to achieve research goals.

It was on this basis that Gordon Green, a longtime station colleague of Campbell and an expert in cereal diseases, began a rust epidemic last summer among 40 000 wheat plants at the station's Glenlea field operation outside Winnipeg. This was simply part of the process to select more rust-resistant varieties. The few plants that reject Green's rust invasion were kept to continue in the breeding process. It is this kind of scientific interchange and cooperation that has also led to the development of Terra, Hudson, Sioux, Kelsey and other oat varieties from the station as well as a collection of durum wheats as opposed to the bread wheat with which Campbell works.

The shutdown of the federal parasite laboratory at Belleville, Ont., in 1972, traumatic for the staff involved, was a bonus for the Winnipeg station because several researchers in the general area of biological control of insects were transferred from Belleville. This area of research is important to Canada in the light of the continuing controversy over the environmental and human risks of the widespread use of pesticides to control insects and plant disease. Effective control of insect pests such as the flea beetle by parasites or other beneficial insects would reduce the need for chemical control agents.

The flea beetle is a particular nuisance for rapeseed growers. It feeds mainly on leaves and pods, but also attacks plant roots. In the spring when plants are small the flea-beetle

Release of a parasite in a rapeseed plot at Glenlea, Man.

Setting up insect-cereal varietal interaction tests in the laboratory.

Dr. A.B. Campbell discarding rust-susceptible plants in rust nursery.

Dr. P. Dyck crossing wheat grown in growth cabinets.

can wipe out a whole crop if left to its own devices. Canada somehow got the flea beetle from Europe in the 1920s and it's been around since, surpassing the Bertha armyworm and red turnip beetle as the most serious rapeseed pest.

As part of the station's flea beetle work, Glen Wylie, one of the Belleville group, is trying to find a parasite that will attack the pest. The complicated process begins in Europe where the flea beetle originated. Over there, flea beetles are collected and held in cages until cocoons bearing parasites appear. These are collected and sent in batches of 300 or 400 to Ottawa where they are stored in cages until parasites emerge.

After a period of quarantine to ensure there are no interlopers, parasites are shipped air express to Winnipeg where they are released into a plot of rapeseed infested with the species of flea beetle (*Phyllotreta cruciferae*) causing the most concern in Canada. The hope is to find a parasite that will find the flea beetle a perfect host and perhaps relieve the farmer of the need for treated seeds and insecticides to ensure he has something to harvest.

Another major research stream, protection of stored crops from insects, had its roots in the federal government's stored products insect laboratory established in Winnipeg in 1946. It too was later incorporated into the Winnipeg station. A major concern of the present-day inheritors of that research tradition is to develop recommendations to enable plant quarantine officials to control insect infestations in overseas-bound grain in terminal elevators. Another is to evaluate commercial pesticides for federal licensing prior to marketing.

Much research effort involves proper ventilation of farm granaries to inhibit insect infestation and maintain the quality of stored grain. Excessive heat buildup can burn kernels. Rapeseed is particularly prone to spoilage because of moisture buildup in granaries which tend to be larger now than formerly. Bigness accentuates the problems.

Fred Watters, the head of the station's cereal crop protection unit, has been working on and off for 30 years on the use of radiation to control insects in stored grain. Given the kind of place the Winnipeg station is, it is no coincidence that Watters joined the old stored products lab as a summer student when it first opened and later became its head before the migration to the Winnipeg Research Station.

Many human and historical connections make a research station function effectively. In the case of the Winnipeg station, one should add the university connection. The research station's physical presence on the University of Manitoba grounds helped cement other connections. Today more than half the station researchers are honorary (permanent) or adjunct (temporary) professors on the university faculty and as such are often involved in such university activities as taking responsibility for graduate students and shepherding them along. It was a University of Manitoba research grant that allowed the venerable Dr. Wallace to return to his old office in the Winnipeg station after his retirement.

Somewhat younger than Wallace is the two-storey brick structure that was the first permanent home of the old Dominion Rust Research Laboratory. It has lost its plaque to the newer, bigger, low-slung rival across the road, but still performs. It contains the complicated paraphernalia used to measure the quality factors (protein content, flour yield and so on) of grains sent in by breeding stations from across western Canada. The samples flow in at the rate of more than 7000 a year. Like Wallace, the old building declines to fade away and the past mixes comfortably with the future.

Mr. Clark is head of Periodicals Services, Information Services, Agriculture Canada, Ottawa.

Organic soil tests in Quebec

J.A. Campbell, A.F. Mackenzie,
H.A. Hamilton

There has always been some controversy about the effectiveness of soil testing. Proper soil sampling requires considerable time and some care. Additional time is also required to fill out the detailed questionnaire which must accompany the samples. In the province of Quebec, analysis centers analyze these samples free of charge, whereas university laboratories charge a fee. The most important practical drawback, however, is the time (often 2 to 6 months) it takes the grower to receive the results and recommendations of the soil analyses.

In addition, there are limitations to the utility of soil tests, particularly organic soil tests, since there isn't a standard set of analytical procedures for organic soil analysis, and laboratories may use different procedures that are not always comparable. To remedy this problem, a manual of standard procedures is being prepared and experiments are underway to determine the laboratory procedures most suitable to determine organic soil nutrients and their levels for best crop yield. Interpretation of the soil tests in relation to yield is made more difficult by variations in yield that occur from year to year and between sites. For example, Mackenzie and Hamilton (1978) found marked variation in lettuce yield from year to year (Figure 1a) and between locations (Figure 1b). With year and site variations of this magnitude it is difficult to estimate optimum fertilization from the data on crop yield and soil test values (Figure 2). Naturally infertile soils recently put under cultivation and those continuously underfertilized tend to respond best to fertilization whereas the most fertile soils or those frequently overfertilized show small responses. The Quebec recommendations compensate for some of these variations by changing the application rates for soils with different levels of fertility.

At present, fertilizer recommendations for vegetable crops are designed to produce maximum crop yields with less regard for the maximum economic crop yield. Hence, it may cost the grower more in fertilizer for the last few increments in crop yield than the additional yield is worth. This is particularly true for soils that have had repeated large fertilizer applications.

Despite these limitations associated with fertilizer recommendations, the risks of not testing an organic soil are great and can result in significant costs to the producer. These risks and resulting costs became apparent in a survey of 86 organic soil sites from more than 70 farms in southwestern Quebec in 1978. The farms were representative of about 4400 ha of organic soil that is cultivated in the area. Thirty-five percent of the sites had less than 20 ppm of copper, indicative of a copper deficiency that would severely limit root crop yields (Figure 3a). Only 6 percent of the sites had soil pH 4.5 and would likely have suffered yield decrease from micronutrient toxicities and deficiencies due to low pH (Figure 3b). However, 10 percent of the sites had a soil pH 6.5 which would also risk lower yields due to micronutrient imbalances. Many of these soils probably also have boron, zinc and molybdenum deficiencies. Levels of plant-available phosphorus in the soils were variable with both underfertilized and some heavily overfertilized sites

Les analyses de sols organiques au Québec

J.A. Campbell, A.F. Mackenzie, H.A. Hamilton

Growing potatoes on organic soil.

Culture de pommes de terre en sol organique.

On discute depuis longtemps des avantages et de l'efficacité des analyses de sols. Pour réussir, les prises d'échantillons exigent un temps assez considérable et certaines précautions. Il faut du temps, également, pour remplir le questionnaire détaillé qui doit accompagner les échantillons. Les centres d'analyse provinciaux effectuent gratuitement l'analyse tandis que les laboratoires universitaires doivent être rémunérés. Le principal inconvénient reste cependant le long délai, souvent de deux à six mois, qui s'écoule avant que l'intéressé ne reçoive les résultats et l'interprétation des analyses de son sol.

L'utilité des analyses de sols a, du reste, ses limites. Il n'existe aucun code reconnu des procédés d'analyse des sols organiques et les laboratoires peuvent recourir à différents procédés qui ne sont pas toujours comparables. Pour corriger ce défaut, on prépare actuellement un manuel de procédés normalisés, et des expériences se poursuivent pour établir les procédés de laboratoire les plus aptes à faire connaître la nature et la quantité des éléments fertilisants nécessaires à l'obtention de bonnes récoltes en sols organiques.

Une autre difficulté dans l'interprétation des analyses réside dans les différences sensibles de rendement qui ressortent d'année en année et entre les endroits. C'est ainsi que Mackenzie et Hamilton (1978) ont relevé des variations considérables d'une année à l'autre, dans les rendements de la laitue (fig. 1a), et d'un endroit à l'autre (fig. 1b). Lorsque ces variations ont une certaine ampleur, il devient difficile d'estimer la fertilisation optimale adéquate d'après le rapport existant entre le rendement de la récolte et la valeur des sols organiques (fig. 2). Les sols naturellement infertiles mis en culture depuis peu, et ceux qui ont été constamment sousfertilisés répondent le mieux à l'application d'engrais. Les plus fertiles et ceux qui ont été fréquemment surfertilisés réagissent peu. Les recommandations du Québec tiennent compte de certaines variations de ce genre en modifiant les taux d'application d'après les niveaux de fertilité.

En règle générale, les recommandations concernant la fumure des récoltes maraîchères visent à une production maximale en attachant moins d'importance à l'économie avec laquelle on atteindra ce maximum. C'est ainsi que les ultimes accroissements de rendement pourront coûter plus cher en engrais au producteur qu'ils ne lui rapporteront. La chose peut se produire surtout pour les sols qui ont reçu, de façon répétée, de fortes doses d'engrais.

Malgré les réserves qui précèdent concernant l'emploi des engrais, les risques encourus en négligeant d'analyser les sols organiques peuvent être considérables et onéreux. Ces risques ressortent clairement du relevé, effectué en 1978, de 86 parcelles de sols organiques appartenant à plus de 70 exploitations du sud-ouest du Québec. Ces exploitations sont typiques des quelque 4400 ha de sols organiques cultivés dans cette région. Dans 35 pour cent des cas on a trouvé moins de 20 ppm de cuivre, ce qui prédispose particulièrement ces sols à des carences de ce métal susceptibles de réduire sensiblement le rendement des plantes-racines (fig. 3a). Six pour cent des endroits seulement avaient un pH inférieur à

(Figure 3c). In a few sites there was more phosphorus in the soil than in the fertilizer itself. Fertilization of these soils would be a waste of money, and could lead to increased environmental pollution. In addition, recent evidence with onion crops has shown that excessive phosphorus fertilization could reduce the yield.

Despite the practical problems in obtaining and evaluating a soil test, it remains the best way of avoiding chemical and nutrient imbalances in organic soils. The survey of these farms has shown in many instances that crop yields could be increased, and that fertilizer costs could be reduced, if more soil testing had been carried out. More research is required to improve the calibration and standardization of existing tests and thus improve the recommendations made to the producer for fertilizer use, and management of these soils in Quebec.

J.A. Campbell is a soil scientist at Agriculture Canada Research Station, St. Jean, Quebec. H.A. Hamilton is a former soil scientist at St. Jean Research Station. A.F. Mackenzie is a professor of soil science, MacDonald College, Ste. Anne de Bellevue, Quebec.

Reference

MACKENZIE, A.F. and H.A. HAMILTON. Calibration des méthodes d'analyses de sols organiques pour les années 1973-1977 inclusivement CRSAQ subvention no 73-53, 1978, 54 pp.

Harvesting lettuce in Quebec. *Récolte de laitue au Québec.*

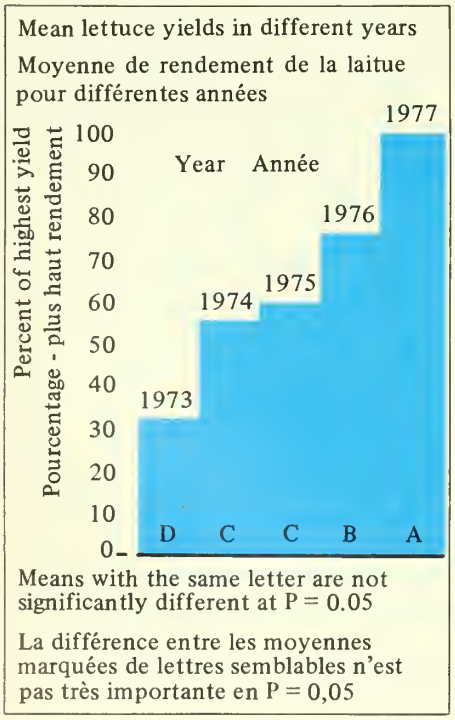
Mean lettuce yields in different years
Moyenne de rendement de la laitue pour différentes années
Percent of highest yield
Pourcentage - plus haut rendement
Year Année
1973
1974
1975
1976
1977
D C C B A
Means with the same letter are not significantly different at P = 0.05
La différence entre les moyennes marquées de lettres semblables n'est pas très importante en P = 0,05

Figure 1. Variation in lettuce yield in fertility field trial plots in southwestern Quebec: (a) variation from year to year; (b) variation between sites.

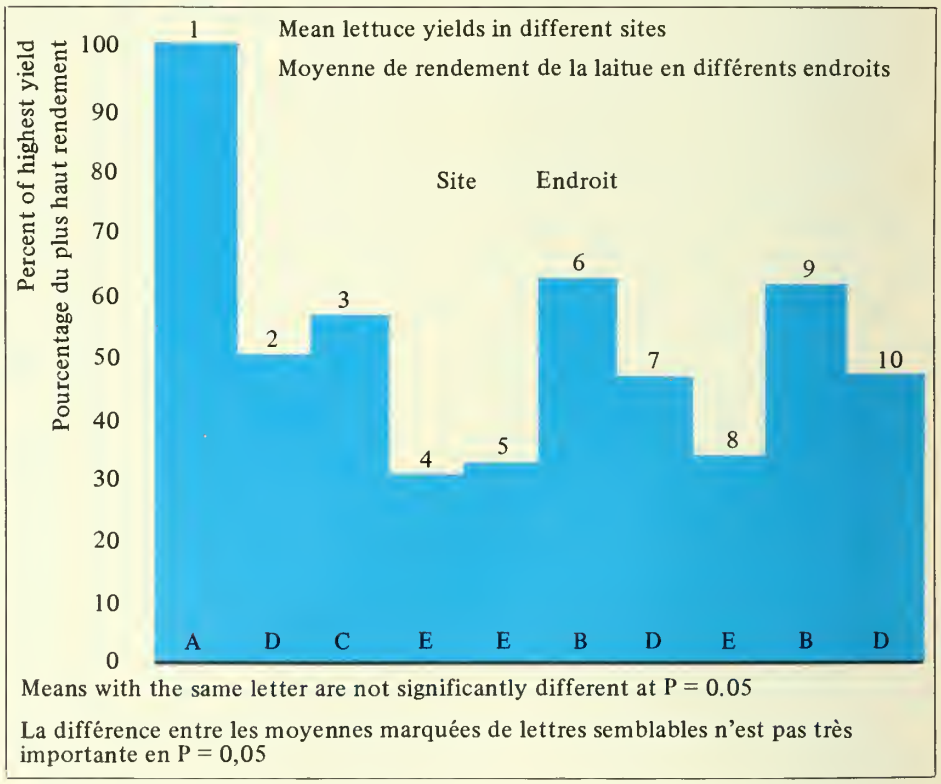
Mean lettuce yields in different sites
Moyenne de rendement de la laitue en différents endroits
Percent of highest yield
Pourcentage du plus haut rendement
Site Endroit
A D C E E B D E B D
Means with the same letter are not significantly different at P = 0.05
La différence entre les moyennes marquées de lettres semblables n'est pas très importante en P = 0,05

Figure 1. Variations des rendements de laitue dans les parcelles d'essai pratique de la fertilité dans le sud-ouest du Québec: (a) variation d'une année à l'autre; (b) variation d'un endroit à l'autre.

4.5 et ces sols auraient sans doute subi une baisse de rendement par suite de toxicités dues à des oligoéléments et de carences imputables à leur faible pH (fig. 3b). D'autre part, 10 pour cent des endroits avaient un pH supérieur à 6.5, ce qui les prédispose également à des rendements réduits par suite d'un déséquilibre dans les oligoéléments. Plusieurs de ces sols sont probablement exposés aussi à des carences de bore, de zinc et de molybdène. Les teneurs en phosphore assimilable par les plantes dans ces sols étaient également variables dans les endroits sousfertilisés et dans certains autres surfertilisés (fig. 3c). À quelques endroits on a relevé la présence de plus de phosphore que dans l'engrais même. La fertilisation de tels sols constitue un gaspillage d'argent pour le cultivateur et peut contribuer à augmenter la pollution de l'environnement. Le même excès de P. dans la fumure pourrait également réduire le rendement des récoltes, comme des constatations récentes le laissent croire dans des cultures d'oignons.

Pour nous résumer, malgré les difficultés pratiques que l'on éprouve à réaliser et à interpréter les analyses de fertilité des sols, celles-ci restent le moyen le plus sûr d'éviter le déséquilibre des éléments chimiques et fertilisants dans les sols organiques. Les relevés effectués dans plusieurs exploitations de cette région ont démontré la possibilité d'augmenter le rendement des récoltes et d'économiser sur les dépenses d'engrais en effectuant des analyses du sol plus fréquentes et en développant la recherche afin d'améliorer la calibration et la normalisation des méthodes d'analyse actuelles.

J.A. Campbell est pédologue à la Station de recherche d'Agriculture Canada, à Saint-Jean, Québec. H.A. Hamilton est un ancien pédologue de la Station de recherche d'Agriculture Canada, à Saint-Jean, Québec. A.F. MacKenzie est professeur de pédologie, département des Ressources renouvelables au Collège MacDonald de l'Université McGill, Ste-Anne-de-Bellevue, Québec.

Référence

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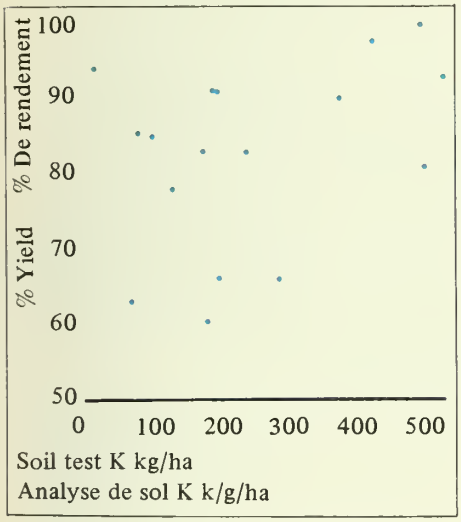


Figure 2. Percent yield of lettuce in fertility field trial plots versus soil potassium test values.

Figure 2. Pourcentage de rendement de la laitue dans des parcelles d'essai pratique de la fertilité, rapporté aux teneurs du sol en potassium relevées par les analyses.

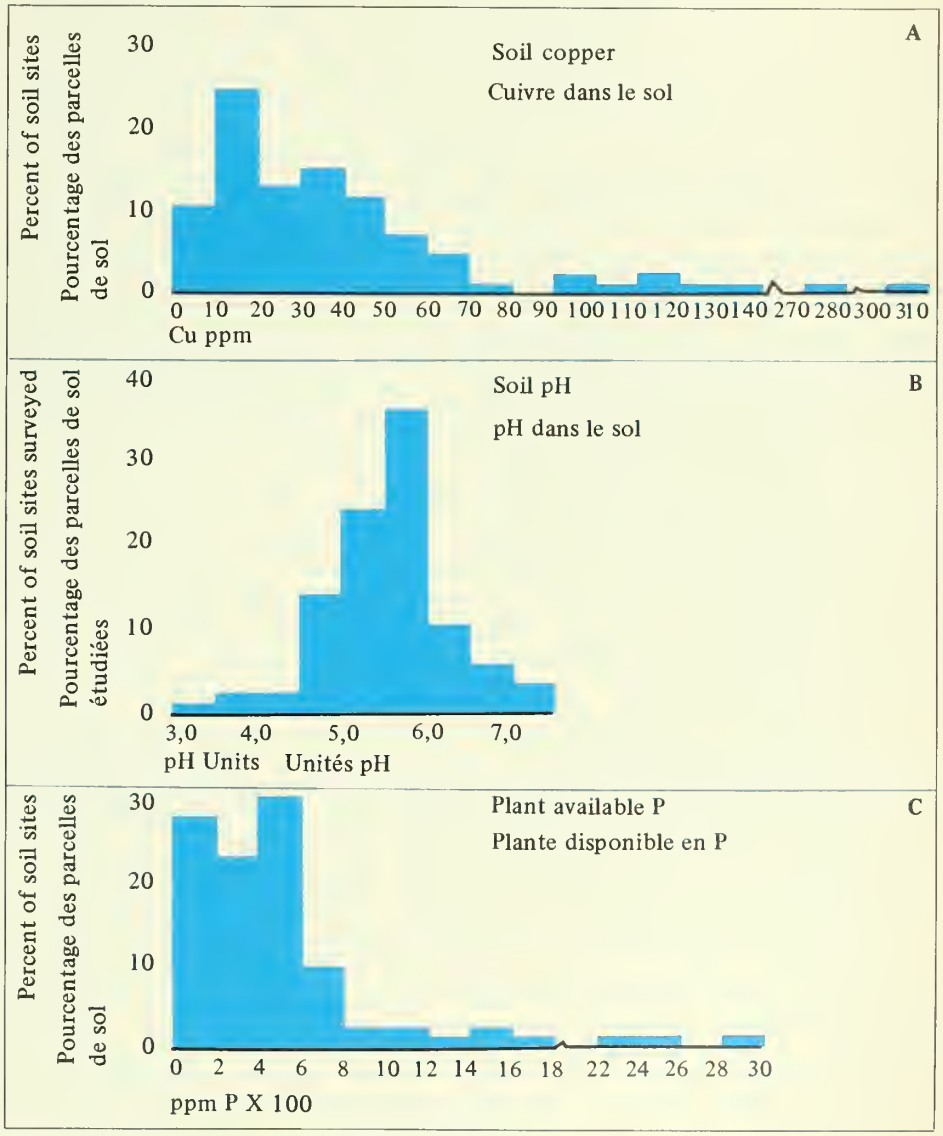


Figure 3. Distribution of selected test values from 86 organic soil sites in southwestern Quebec: (a) Cu, total by dry ashing method; (b) pH, in .01M $CaCl_2$ 1:8 soil extract ratio; (c) plant-available P. extracted by 1N HCl 1:10 soil extract ratio.

Figure 3. Répartition des teneurs d'analyses choisies parmi les 86 sols organiques du sud-ouest du Québec: (a) Cu, total d'après la méthode de réduction en cendre sèche; (b) pH, rapport de l'extrait de sol en .01M $CaCl_2$ 1:8; (c) rapport de l'extrait de sol en P assimilable par les plantes extrait par 1N HCl, 1:10.

Peanuts - A new Canadian industry

Le Nouveau Fond de développement des cultures a été instauré dans le but d'aider au financement d'études d'un grand nombre de facteurs relatifs au processus d'introduction d'une nouvelle forme de culture. Le présent article traite de certaines expériences se rapportant aux arachides dont la production est en voie d'être commercialisée au Canada.

J.T. Phalen

A research project strongly supported by the federal government is accumulating considerable data on the feasibility of growing peanuts on Southern Ontario farms, particularly in the tobacco-growing areas. Federal financial involvement has come through the agriculture department's New Crop Development Fund, set up in 1974 to promote the introduction of new crop varieties in Canada through financial aid to developmental — as opposed to basic — research. Results so far tend to favor the idea of growing peanuts in Canada. Adding impetus to the project is the arrival in 1980 of Canada's first commercial peanut crop.

Peanuts were harvested from 180 acres on six farms for the first time

last fall to feed a processing plant especially built for this purpose by entrepreneur Jim Picard in the Simcoe district of Southern Ontario, a tobacco-growing region. The Picard plant features a retail outlet at the front to sell peanuts locally, but the major market for his raw peanuts will be manufacturers of peanut butter, vegetable oil and confections of various kinds. The Picard plant has the capacity to shell, roast or fry peanut production from 4000 acres annually. Picard hopes to be handling this kind of volume within 6 years. A farmer himself, Picard became interested in peanuts initially as a substitute for corn on light soil.

Peanuts as a crop have been traditionally associated with more southerly climates as in Georgia, where the most notable peanut operator of the time is Jimmy Carter, former U.S. president. Absence of commercial peanut production in Canada until the 80s meant that Canada annually imports peanuts and peanut products equivalent to 95 000 t of the raw product. If peanut growing catches on in Canada, the possibility of exporting exists as well as supplanting imports for domestic use. The types most likely to be grown in Canada have been found to be free of aflatoxin, a potential carcinogen, sometimes found in peanuts grown in warmer climates.

The peanut project is one of many supported by the federal New Crop Development Fund. But there was financial, technological and manpower involvement from many other quarters over the past 6 years to select the most appropriate peanut varieties to grow and provide all the other basic information to create a foundation for what is hoped will be a substantial Canadian industry. The federal fund contributed more than a half million dollars so far, with lesser but substantial amounts from the Ontario Ministry of Agriculture and Food and the University of Guelph, which played and continues to play a major role in the ongoing project. There was also private contribution in money, research and testing.

Project coordinator is Dr. J.W. Tanner of the University of Guelph's crop science department. Much research by university and federal government personnel was

J.M. Elliot observing the development of the peanut plant.

carried on at Agriculture Canada's research station at Delhi, Ont. This is in the tobacco region, an area of light, sandy soils thought at the outset to be suitable for peanut growing. The wide-ranging agronomic research carried on there included fertilizer trials, variety selection, fungicide experiments, irrigation evaluation, testing management practices, and engineering trials. Approximately 3600 variety lines from around the world were screened at Delhi. From these, six lines of Valencia peanuts were selected which yielded better then existing U.S. Valencia varieties in test plots.

Engineering problems arose in adapting traditional peanut crop handling methods to the new Canadian environment. For example, in most of the world, peanuts are dug up and inverted (foliage down, peanuts up) and left to field-dry in windrows, before combining or otherwise removing the peanuts from the plants. Because of heavy fall rains in Ontario, field drying for even a few days could be disastrous. As a result, several alternatives to standard harvesting procedures were examined. One novel and promising method involves adapting a conventional peanut digger to strip peanuts from the plants and collect them for off-field drying.

Off-field drying also involves problems. Freshly dug peanuts have a high moisture content (60 to 65 percent weight basis). Leaves and wet soil tend to cling to the peanut shells, adding to the weight and the moisture to be removed. If the moisture content of dug peanuts is not reduced rapidly to the acceptable level of 10 percent, moulds form, kernels become water-marked and off-flavors tend to develop.

Considerable attention is being given to testing commercial driers that are now on the market, particularly those used in drying tobacco since such facilities are readily available throughout the area where peanuts would be grown in Ontario. Adaptations appropriate for drying peanuts are being developed, tested, revised and retested in order to upgrade the efficiency of the drying process.

Peanut plants flowering at the Delhi Research Station.

Examining peanuts being grown in a tobacco- peanut-rye rotation.

Artificial drying of peanuts requires much energy and extensive drying facilities. A novel drying technique under investigation is the use of high-temperature flame to dry freshly dug peanuts. This not only dries the peanuts, but also the adhering soil and leaves so that they may be shaken off. An additional benefit is that peanut shells are easier to crack after exposure to high temperature making them easier to shell.

Researchers have also investigated the use of desiccating agents, using calcium chloride and bentonite as possible media for reducing moisture content of freshly dug peanuts. For example, by arranging the peanuts in vertical columns alternating with columns of calcium chloride separated from the peanuts with a thin wire mesh, the moisture content of the peanuts was reduced to less than half in 3 days and to one-third of the initial amount in 6 days.

Early studies have demonstrated that application of granular rhizobium inoculant at seeding precluded the need for nitrogen and therefore peanuts can be grown on high-fertility tobacco soils without the use of commercial fertilizer. A major factor contributing to the high fertility of soils is a 2-year rotation of tobacco and rye which is a common practice in the Delhi area. Thus a natural extension of research activities at the Delhi Station was the inclusion of peanuts in rotation experiments. A 3-year tobacco-peanut-rye rotation produced results that led researcher J.M. Elliot to say that the 3-year rotation had advantages over the more common 2-year rotation. He also says if the demand for tobacco declines, peanuts appear to be a reasonable alternative, but under present circumstances peanuts will not likely replace tobacco in that area.

Before a new crop will be widely accepted as an alternative to crops being grown, producers must be convinced that a change is to their economic advantage. If peanuts are to replace or be combined with tobacco, corn or other crops, the economic advantages must be clearly demonstrated. Budgets worked out to date indicate that a reasonable level of returns may be expected from peanuts, particularly if yields can be raised above experimental field plot yields of 2000 pounds an acre.

The complexity of introducing a new commodity into the agricultural scene is clearly demonstrated in the peanut experience. Wide-scale producer participation is the final and most important step in the successful completion of the peanut project. Although this step is yet to be realized, the essential evidence for success or failure has been demonstrated and a smooth and rapid acceptance of the new crop seems predictable.

New crop development fund

Since its beginning in 1974, Agriculture Canada's New Crop Development Fund has committed about $4.3 million to assist more than 50 agricultural research projects across Canada.

The fund's objective is to stimulate the development of new crops and varieties, new growing areas for established crops and new uses and production methods for these crops. The fund is designed to bridge the gap between basic research and commercial production.

Assistance under the fund is available to Canadian commercial companies, industry and producer organizations, universities and provincial government agencies. The fund operates on a cost-sharing basis.

To be eligible for funding, an organization must show adequate financial, physical, technical and managerial capabilities to carry out its proposed project.

The focus is on the development of crops currently grown on a small scale, as well as on new crops that show potential for Canadian agriculture.

A booklet, "New Crop Development Fund," is available on request from:

New Crop Development Fund
Secretariat
Agriculture Canada
Marketing Services Division
Room 6120
Sir John Carling Building
Ottawa, Ontario
K1A 0C5

Mr. Phalen is an information officer with Information Services, Agriculture Canada, Ottawa.

The arrival of serum banking

J.A. Kellar

The Canadian government has followed the lead of some other countries and moved into the field of animal serum banking. This system permits accurate readings on disease presence in domestic animal populations and thereby assists researchers to find ways to improve animal health. Serum banking involves the collection of samples of a blood component (serum) from a representative group of a particular kind of domestic animal. The samples are freeze-dried and stored. In this state, they are available indefinitely for analysis to determine the extent of animal ailments in a given population at a particular time. The disease must be one that can be identified through blood sera. Identification through blood sera is the art of serology.

Le présent article décrit le rôle de la sérologie en matière de distribution et niveaux des maladies ainsi que les méthodes de stockage de serum.

In the assessment of the health status of a population, be it human or animal, the investigator has three major tools: (1) clinical examination involving a direct physical look by the investigator; (2) autopsy (or postmortem) in which the investigator dissects and otherwise examines the body of a dead human or animal; and (3) clinical pathology in which specimens from living animals or persons are examined and analyzed. Serology falls into this third category.

The three methods vary in expense and ability to detect disease. Clinical and postmortem examinations are expensive and labor-intensive, and therefore restricted in use. On the other hand, clinical pathology examinations are usually less expensive, partly because of en masse applications. Common applications in humans include urine screening for diabetes mellitus in children at school and serological examination for syphilis in blood donors. Animal health applications include the examination of the serum component of blood for disease antibodies to detect such diseases as brucellosis in cattle.

In terms of ability to detect disease, clinical and postmortem examinations are restricted to identifying those animals actually ill or having died of an affliction, or coincidentally bearing scars of the disease discovered upon examination for some other reason. The normal natural course of a disease (be it the 'flu' in man or distemper in dogs) results in many animals or persons being infected but few becoming ill or dying. It is clear that only the tip of the iceberg is represented by clinical and autopsy results. When we realize that greater economic loss often occurs in animal populations from animals 'subclinically' ill (an illness not particularly apparent on a clinical examination) than from actual deaths, we begin to understand and accept the role of serology in determining disease distribution and levels.

Serology, in effect, looks for "footprints" of disease. Most bacteria, viruses, etc., that invade an animal cause the production of antibodies to fight the invader. These "footprint" antibodies survive for months and possibly years after the invading agents have moved on to new hosts. Serological limitations lie in the fact that: (1) not all disease agents cause the formation of antibodies detectable by current methods; (2) some germs create confusion by causing the formation of antibodies very similar to those produced by other germ types; and (3) animals require a period of time following infection before they can mount a serologically detectable response. Nevertheless, serology's value far outweighs its deficiencies, and it plays a major role in disease detection programs such as for brucellosis in Canadian cattle.

In the course of disease eradication programs in animals, some national governments collect millions of blood samples annually. These blood samples lend themselves to auxiliary testing for other economically important diseases. Samples can be analyzed immediately or can be stored away (freeze-dried like instant coffee) for later use to clarify the history and distribution of *new* diseases which may make an appearance in later years (*new* is used in the sense that previously the disease had not been recognized clinically or by autopsy). An example in human medicine is Legionnaire's Disease. Analysis of a serum bank in Florida revealed the presence of Legionnaire's disease in the United States years before its dramatic appearance in Philadelphia in 1976.

The veterinary services of Australia, New Zealand and several European countries have had serum banks for some time, derived from specimens collected during disease control programs. These collections have been "passively" collected, that is, derived from samples collected for other reasons. Such a collection is relatively inexpensive to accumulate, but is not completely reliable as a measure of the national disease status as it is derived only from a group of animals being tested for other reasons. The result reflects the health status of only that particular group, which may not be distributed evenly in numbers or locations across the country. It could thus be biased in its estimates.

The Food Production and Inspection Branch of Agriculture Canada decided in 1979 to accumulate its own cattle serum bank. The branch believed that a true depiction of the national herd's disease status demanded an "active" collection, that is, samples obtained from a study statistically derived to reflect husbandry, breed, herd size and other factors that contribute to disease types and distribution.

Obtained from Statistics Canada was a computer-selected grouping of over 1000 herds distributed evenly across the country. A second list of more than 2000 herds was made available as matching replacements should any of the original herds be unavailable.

With the cooperation of the farming community, more than 38 000 serum samples were collected, iden-

tified, freeze-dried and stored at the branch's Animal Disease Research Institute near Ottawa. A questionnaire was filled out for each herd, containing complete herd information and information describing each animal. Information gathered was computerized. As a result, serum samples from cattle are readily available to researchers according to breed, geographic region, age, sex, etc. A researcher merely reconstitutes the freeze-dried vials (like adding water to coffee crystals) and performs his analysis. He can even refreeze what is left over if absolutely necessary. Results of tests are entered in individual animal files in the same computer program for statistical analysis.

Since all the samples are freeze-dried, they can be shelf stored at room temperature for years. The accumulation of a series of such collections, at 3- to 4-year intervals, will permit the assessment of disease trends and help to guide Agriculture Canada's activities in developing programs to combat them in the most cost-effective manner.

Dr. Kellar is Chief, Brucellosis Planning, Food Production and Inspection Branch, Agriculture Canada, Ottawa.

Lymphoid leukosis in chickens: A source of economic loss to be eliminated

J.L. Spencer and J.S. Gavora

For a laying hen to produce more than 280 eggs in a year and for a broiler chicken to attain market weight in 6 or 7 weeks are achievements made possible only because of the close working relationship that has existed between the poultry industry and research laboratories. While chickens have been successfully bred to achieve high productivity, inadequacies in management, nutrition or in disease control can prevent them from producing to their full genetic potential. In recent years, the poultry industry has become increasingly aware of the economic importance of lymphoid leukosis and poultry breeders are already applying new technology in an effort to control this disease.

La leucose lymphoïde représente un défi particulier pour les chercheurs et toute l'industrie de la volaille car c'est une maladie extrêmement complexe. Elle a pour effet de réduire le volume de production des oeufs et de diminuer le pouvoir de résistance à la maladie chez les volatiles. Les techniques modernes permettent cependant de réduire et même d'éliminer totalement cette maladie.

Agriculture Canada research has played a major role in stimulating this interest. It was found that laying hens which appear to be healthy may have a lymphoid leukosis virus infection in the reproductive tract. Such infections may be reducing production in Canadian poultry flocks by 60 to 120 million eggs per year. Although 10 to 20 percent of the mature chickens in an occasional flock may die with massively enlarged livers or other lesions typical of lymphoid leukosis, the mortality rate is usually low and in the past has not caused great concern. However, our recent data suggest that inapparent infections may reduce the host's resistance to a number of diseases and thus contribute significantly to the total mortality picture.

The Canadian research investment has provided the poultry industry with a test procedure that will assist in the control of lymphoid leukosis. The test method was developed cooperatively with United States Department of Agriculture scientists at the Regional Poultry Research Laboratory in East Lansing, Michigan. The discovery was that a protein of the lymphoid leukosis virus was present in the albumen of eggs from most hens that have an infection in the albumen-secreting region of the oviduct. This protein, known as group specific viral antigen, is detected by the complement fixation test.

The Agriculture Canada research is being conducted at the Animal Diseases Research Institute and the Animal Research Institute, both in the Ottawa Greenbelt.* The availability of well defined strains of chickens and the existence of detailed production and egg quality records which were maintained as part of the genetics program at the Animal Research Institute have been important factors in investigating the influence of lymphoid leukosis viruses on egg production.

*In addition to the authors, Dr. R.S. Gowe, Director of the Animal Research Institute, is contributing to these studies.

The virus and the disease

In 1908, Danish scientists produced evidence that they could induce tumors in chickens by means of a virus. The virus these early investigators worked with is now known to be the causative agent of lymphoid leukosis. The virus can infect virtually any of the cells in the chicken's body and yet cause no visible harm unless it attacks certain target cells and causes them to transform. These target cells are located in what was until recent years an obscure organ known as the bursa of Fabricius.

The virus is transmitted from one generation to the next through the egg. In this form of transmission, a virus released from cells of the hen enters the developing embryo and multiplies in virtually all types of cells throughout the body. While only about 5 percent of the chicks are infected in this manner, they shed viruses in their droppings which become a source of infection for other chickens.

Technology developed in California in the early 1960s made it possible to eradicate lymphoid leukosis virus from chicken flocks, but the procedures were far too costly and inefficient to be applied on a commercial scale. However, some flocks used for research or production of vaccines were freed of the virus and have remained free of the infection for approximately 15 years.

The virus and egg production

Chickens infected with a virus during embryonic development, as well as some that are infected after hatching, develop an infection in the oviduct which persists throughout their lives. Most of these infected hens can be readily identified by using the complement fixation test to detect viral antigen in egg albumen.

The first indication that lymphoid leukosis virus infections in the reproductive tract were adversely influencing egg production resulted from a survey for viral antigen in eggs from strains of chickens that had been under selection for high egg production and from unselected control strains at the Animal Research Institute. It is readily apparent from Figure 1 that the shedding

TABLE 1. Reduced production and increased overall mortality associated with lymphoid leukosis virus infection in the reproductive tract*

Trait	Average for hens that were: Shedders of Viral Antigen	Non-Shedders	Difference (affect associated with infection)
Sexual maturity	159.7 days	156.7 days	+ 3 days
Egg production per hen housed	229 eggs	259 eggs	-30 eggs
Egg weight	54.9 g	56.2 g	-1.3 g
Egg specific gravity	1.0844	1.0860	-0.0016
Mortality from lymphoid leukosis	0	0	0
Mortality from other causes	15.4%	5.0%	+ 10.4%

*Data from chickens hatched in 1976. Results from the 1977 hatch were similar.

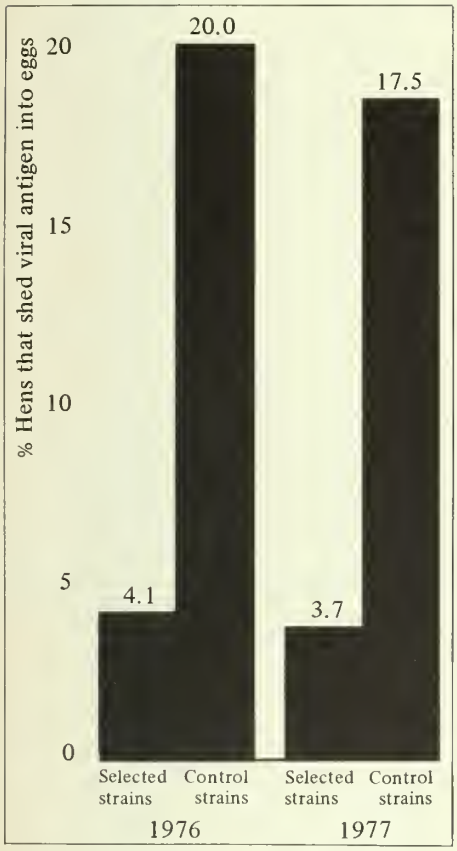


Figure 1. Selection for high egg production reduced viral infection.

of viral antigen into eggs occurs much less frequently among hens of selected strains than among those of control strains. The explanation for these differences is based on findings reported in Table 1.

Pullets found to be shedding viral antigen into their eggs are slower to reach sexual maturity and produce fewer and smaller eggs with lower specific gravity (thinner shells) than those of non-shedders. Thus, in the process of selecting the most productive chickens for breeding purposes, hens shedding viral antigen would likely be eliminated. In selection studies, unselected control strains are maintained and used for the evaluation of genetic progress achieved by selection. In the control strains, the breeders are randomly selected without any consideration of their production. Consequently, shedders of viral antigen are much more likely to be used as breeders in control strains than in selected strains. Another interesting observation in the table is that there was no mortality from lymphoid leukosis, but mortality from all causes was higher among hens that shed viral antigen into eggs than among non-shedders.

Perspectives

The poultry industry is unique within animal agriculture because only about a dozen large poultry breeding companies supply the vast majority of commercial chickens used throughout the world. These breeders are keenly aware of disease and it is at the breeder level that diseases which are transmitted through the egg must be controlled. In the past, a number of egg-transmitted diseases such as pullorum disease, fowl lymphoid and mycoplasma infections have been eliminated. Lymphoid leukosis presents a special challenge to poultry breeders because it is a very complex disease and egg transmission tends to be erratic. Nevertheless, with the technology now available the incidence of the infection can be substantially reduced. As cooperation between industry and research laboratories continues there is optimism that the disease will be eliminated.

Dr. Spencer is a poultry diseases specialist at Agriculture Canada's Animal Diseases Research Institute, Ottawa, and Dr. Gavora is a poultry breeding specialist at Agriculture Canada's Animal Research Institute, Ottawa.

Measuring field persistence of herbicides using micro-plots

Allan E. Smith

Three procedures can be used to study the persistence of herbicides under field conditions. The first is to use orthodox spraying equipment to treat the crop, or soil, in the recommended manner. The second technique is to treat small plots using carefully calibrated sprayers mounted on bicycle wheels. The third method, that of using micro-plots, has several advantages over the first two.

The first technique, the use of orthodox spraying equipment, seems simple but is not easy to put into practice. After the desired time intervals following herbicide application, soil corers are used to sample the treated soils and the pooled soil cores are mixed and analyzed for residues. Problems with this method arise from the fact that existing spray equipment does not apply the chemicals with a very high degree of uniformity. Further difficulties arise if the herbicide has to be soil incorporated, as is the case with dinitramine, triallate, and trifluralin, since uniform chemical incorporation is very hard to achieve. The chemicals can be in the top 2 cm in certain parts of the treated soils and in the top 10 cm in other areas. Even by sampling dozens of cores it is almost impossible to obtain reliable and reproducible data by such means.

Le concept des micro-parcelles pour déterminer la persistance des herbicides a été développé et largement utilisé en Saskatchewan. L'article qui suit en décrit les principes et établit des comparaisons avec d'autres méthodes disponibles.

The second technique used to determine field persistence of herbicides is to treat small plots (usually 1 m x 4 m) using carefully calibrated sprayers mounted on bicycle wheels to apply the chemicals. Since the chemicals can be applied with reasonable uniformity, one of the difficulties encountered in the orthodox field approach is eliminated. Core samples can then be taken after

various time intervals and the herbicide content measured. Persistence data from such experiments can be quite reproducible. The main drawbacks to this procedure are the amount of land required for the study and the time taken to set up the various treatments. To compare persistence on different soil types requires even more land and time.

The concept of micro-plots was developed to overcome some of these problems. Clearly, if the plots are small enough they can be quantitatively treated by adding the chemical directly to the soil by means of a pipette. Incorporation, if required, can be carried out with a small fork and the herbicide mixed with the soil to a known depth. At the sampling date, all the treated soil at different depths can be removed from the plots. Field space is minimal, treatment rapid, and the persistence at various locations can be compared. As all the treated soils are removed, subsequent land use is not affected by persistent chemicals remaining at the end of the experiments.

Practically, it was found that a plot dimension of 20 x 20 cm, or 400 cm^2, is a suitable size for the micro-plots, and that the weight of soil from such plots, taken to a depth of 5 cm, is approximately 2 kg.

In early spring the ground is worked with a harrow or discer to a depth of 5 to 10 cm. Later, the soil is raked level. At treatment time, usually in late May or early June, a metal former constructed of 1.5 mm sheet metal, measuring 10 cm deep and with an internal area of 20 x 20 cm, is placed in the raked area, secured by four small stakes at the corners. The herbicide, as a commercial formulation, is applied, in methanol, by zig-zagging the solution over the surface of the enclosed plot. Usually 2 mL of solution are applied and the concentration of the herbicide is reflected by its application rate. For a rate of 1 kg/ha, 4 mg herbicide per plot are required. If the chemical is to be incorporated following treatment, a small fork is used to carefully mix the soil to the required depth. Other herbicides that do not need soil incorporation are left as surface applications. Finally the soil surface is tamped down and the metal former removed. Usually 12 replicate plots are treated for each chemical and each application rate to allow for sampling over a 2-year period, if necessary.

The plots are carefully weeded by hand during the course of the study. At each sampling date the square former is placed around the four corner stakes of the plots and pounded into the soil to a depth of 5 cm. The soil from this level is carefully removed with a small shovel and stored in an empty 2-L milk carton. The metal former is then pounded to a depth of 10 cm and soil from the 5 to 10 cm plot depth is removed and stored in a separate carton. Usually three or four replicate plots are sampled in this manner. In the laboratory the soils are dried at room temperature on sheets of newspaper until constant weight is achieved. The soil samples are then ground and thoroughly mixed in a laboratory mixer for 15 minutes to ensure even distribution of the residues. The soils are then returned to their respective cartons and stored at room temperature for future analysis.

Data collected over 10 years using this technique have indicated that results are reproducible and that variation between analyses from replicate treatments is minimal. Typical results are displayed in Table 1, which compares the persistence of triallate in field soils at several Saskatchewan locations.

Brian Hayden, Regina Research Station, applies a herbicide to one of the micro-plots.

Micro-plots are easy to set up and sample, and two people can manage 100 in a day. The technique works best for those herbicides which are absorbed strongly to soils and therefore undergo minimal leaching. For water-soluble herbicides that are extensively leached, such as picloram and bromacil where both lateral and vertical movement can occur, the micro-plot technique is limited. Other limitations are the smallness of the plots and the need to protect them from flooding and the depredations of gophers. Also, because it is necessary for the plots to remain fallow, herbicide persistence may be affected to some degree.

In general, the advantages outweigh the disadvantages. The micro-plot technique has been used to study the persistence of more than 30 different herbicides at various locations in Saskatchewan.

TABLE 1. Percent of applied triallate remaining in October after May treatments of 1.5 kg/ha

Site	Remaining (%)*
Regina	16 + 5
Jameson	26 + 3
Indian Head	20 + 3
Melford	27 + 4
Tisdale	21 + 7

* Mean and standard deviation from analysis of four plots. Less than 2% of applied chemical in 5 to 10 cm soil depths.

Dr. Smith is a research scientist at Agriculture Canada Research Station, Regina, Saskatchewan.

Discovery of a sporulating state for the LTB snow mold

J.A. Traquair

Growth of low-temperature fungi that cause snow mold damage to overwintering, herbaceous plants is favored by heavy and prolonged snow cover. Under such conditions, extensive snow mold damage can occur on turf and forage grasses, perennial legumes, and fall-sown cereals.

La Station de recherches Lethbridge d'Agriculture Canada a récemment progressé dans la connaissance des cycles de vie de mycètes à basse température qui provoquent de la moisissure nivale à certaines plantes vivaces comme le gazon, les légumes et les céréales. Ces nouvelles connaissances aideront à l'établissement de nouvelles mesures de contrôle efficaces.

In western Canada, one particular snow mold pathogen known only as a low-temperature basidiomycete (LTB) is found on a broad range of overwintering hosts in the Yukon and all of the western provinces. The fungus has remained unidentified because sporulating structures had not been observed in nature or in culture. Although LTB has a wide geographic distribution, the means by which it is spread over long distances has been a mystery for over 40 years. Furthermore, because our understanding of the biology of this pathogen was incomplete, the development of effective control measures was seriously hampered.

Recently, a major advance in our knowledge of the life cycle of the LTB snow mold has been made at the Lethbridge Research Station. Mushroom-like sporulating structures were observed for the first time on alfalfa and winter wheat damaged by LTB. These sporulating structures (basidio-carps) have now been identified as the sexual reproductive state of a new *Coprinus* species closely related to *Coprinus urticicola*. Further taxonomic studies of this and some closely related *Coprinus* species are underway in cooperation with the Biosystematics Research Institute in Ottawa.

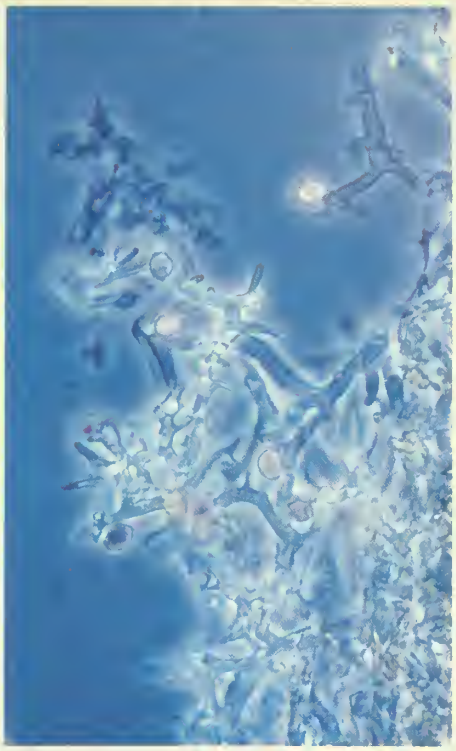


Figure 2. Antler-like cells from the cap scales and thick-walled basidiospores.

The sporulating structures of the LTB *Coprinus* are inconspicuous and short-lived in the field, making their detection very difficult. They are white and very small (7-12 mm wide and 20-30 mm tall) when young. When mature, the stalk is 20-50 mm long and the expanded cap is grey and ornamented with delicate, flocculent, yellowish-brown scales. These scales are characteristic because they consist of antler-like cells with colorless to yellowish, refractile cell walls. The gills, or lamellae, on the underside of the cap become brownish black due to production of chocolate-brown, thick-walled, elliptical basidiospores and the onset of breakdown. Basidiocarps develop very rapidly, in moist weather, usually in the fall. Within 24 hours, basidiocarps mature and begin to self-digest.

A genetical tool was used to identify sterile isolates of the LTB snow mold from diseased tissues of alfalfa, turf grass, and winter wheat. In this procedure, the ability of single-spore isolates from known basidiocarps to mate with sterile, unidentified isolates from the *Coprinus* species with dicaryotic isolates of the snow mold LTB showed that they were the same species (Table 1). This evidence for the close relationship of the two fungi is supported by similarities in their cultural features and pathogenicity. Both fungi produce cottony or woolly mycelium, parasitize

Figure 1. Mushroom-like sporulating structures of the low-temperature basidiomycete (LTB) on alfalfa (A) and winter wheat (B) crowns.

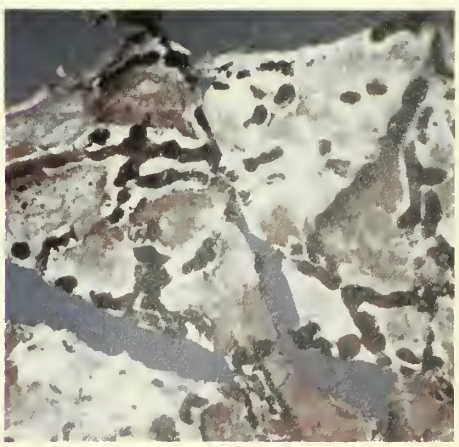


Figure 3. Irregular-shaped sclerotia of the LTB Coprinus *on fallen poplar leaves.*

TABLE 1. Mating *Coprinus* isolates with unidentified isolates of the snow mold LTB

Snow mold isolates		Single-spore *Coprinus* isolates JT 1286	JT 1291	JT 1292
Coprinus	JT 1286	+	+	+
	JT 1291	+	+	+
	JT 1292	+	+	+
	JT 1334a		+	
LTB	W 1	+	+	+
	W 2	+	+	+
	JT 1284		+	
	JT 1269		+	
	JT 1293		+	
Typhula	JT 1267		-	
Marasmius	JT 1251		-	

+ denotes compatibility.

- denotes incompatibility.

alfalfa and winter wheat under cold conditions in growth chambers, and produce hydrogen cyanide during breakdown.

Presence of a spore-producing stage is consistent with the wide distribution of LTB in western Canada. In addition, this pathogen produces hard, blackish sclerotia that allow it to persist in the soil and to resist desiccation during the summer months. Sclerotium production in culture and in the field by certain strains of LTB has been noted by Mr. Drew Smith (Saskatoon Research Station). We have observed that the strains that do not produce typical sclerotia in culture may produce them under field conditions. Both the non-sclerotial and sclerotial strains of LTB mate with the *Coprinus* species in genetical tests.

Finding a sporulating state for the snow mold LTB is a landmark event in plant pathology and will greatly facilitate the development of control measures. We are now studying the mechanism of infection and the basis for resistance in certain cultivars. This information will help in the development of forage crops and winter cereals that are resistant to snow mold.

Dr. Traquair is a plant pathologist and mycologist at the Agriculture Canada Research Station, Lethbridge, Alberta.

Development of a commercial fruit dryer

A.L. Moyls

A prototype commercial fruit dryer designed specifically for the production of fruit leathers has been developed at the Summerland Research Station. The unit operates on a batch, rather than a continuous, production basis. Leathers are made by passing hot air over large flat trays of pureed fruit until most of the moisture is removed and the desired cohesive leathery product is obtained. Puree that is initially levelled to a 10 mm depth dries to about 2 mm thickness in 4 hours. It contains about 12 percent moisture, is quite tough and leather-like, and can be stored indefinitely when cut and packed. If left unwrapped it will equilibrate with the atmosphere in which it is placed. Hence, a humid atmosphere will cause it to pick up moisture and shorten its shelf life. Suitable leather can be made from numerous fruits such as apples, apricots, raspberries, peaches, blueberries, and various blends. The product is light, tasty and pleasant to chew, ideal for snacks or camping. Most of the fruit used can be harvested mechanically and, since it is pureed, there is no need for fancy grade.

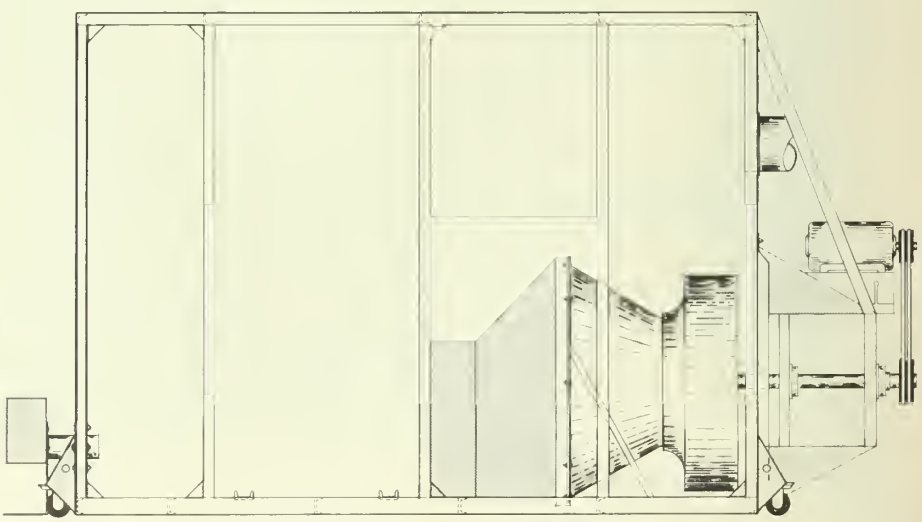
Preliminary studies were done with a small dryer at the Summerland Station. They gave rise to the design of a commercial unit that had as short a drying time as is practical.

The body of the commercial unit is an insulated metal box measuring 2.1 x 2.1 x 3 m (7 x 7 x 10 ft) as shown in Figure 1.

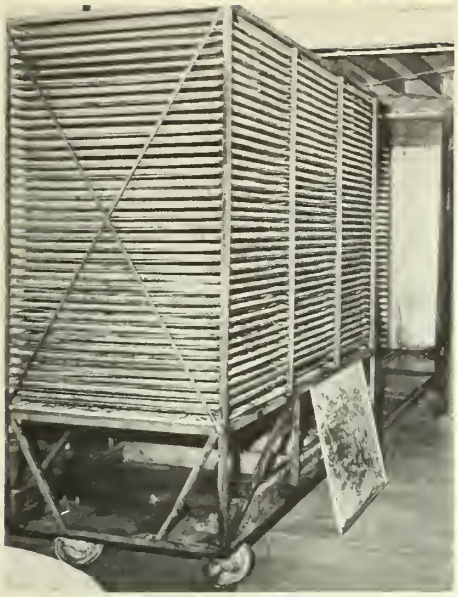
Sheet metal forms the inner and outer walls which are separated by fiberglass insulation. To obtain high initial evaporation rates a 157 000 kcal/h (600 000 BTU/h) gas-fired heater was installed at one end of the box and a 1-m (40-in.) centrifugal blower capable of circulating 560 m^3 (20 000 cubic ft) of air per minute was installed at the other end. Fresh air is continuously bled into the dryer through a 25-cm (10-in.) duct near the blower. Most of the air is circulated across the puree trays held in a rack and then is drawn back underneath the rack to the blower inlet.

The tray rack employs three vertical rows that space the trays 3.8 cm (1.5 in.) apart. This gives an initial air space of 2.5 cm (1 in.) between the puree surface and the bottom of the tray above it. The frame of the tray rack is mounted on casters to make a moveable tray dolly. The

Des études préliminaires d'une petite sécheuse à fruit ont été effectuées à la station de recherche Summerland d'Agriculture Canada. Un prototype a ensuite été construit pour le traitement des écorces de fruits déshydratés. Le présent article décrit le fonctionnement de cet appareil qui est à présent commercialisé.



Side elevation of fruit dryer.



Fruit trays and dolly.

loaded dolly is wheeled into the dryer and the unit is operated for 2 to 4 hours to remove a large portion of the moisture from the fruit. The dolly is then wheeled out, turned around and re-inserted for the completion of the process which requires another 2 to 4 hours.

The turn-around procedure facilitates uniform drying of the product. Essentially it reverses the tray orientation so that the upstream edge which receives fresh drier air becomes the downstream edge in the latter half of the process. If the trays are not reversed the upstream side gets overdried while the downstream side remains too moist.

The body of the unit and the tray dolly were constructed by a local engineering firm, but it was necessary to fabricate the 114 trays at the Research Station in order to maintain uniformity.

The trays measure 86 by 69 cm (34 by 27 in.) and are made from 20-gauge sheet steel. A large drawing die was made to punch the trays out of blank sheets using a 60-ton hydraulic press. A typical tray is shown leaning against the tray dolly in Figure 2. It was necessary to line the trays with sheets of 0.127mm (0.005 in.) Mylar to facilitate product removal.

The tray depth was 16 mm (5/8 in.). It was initially intended to fill the trays to a puree depth of 9.5 mm (3/8 in.) which gave the unit a capacity of 680 kg (1500 lb) and required 4 to 5 hours to dry a final weight of about 135 kg (300 lb). The company that financed the construction, Okanagan Dried Fruits Ltd., found it more expedient to fill the trays to the brim since it was quicker to run a puree leveling stick over the top edges of the trays. This 16 mm (5/8 in.) depth gave a 11.36 kg (2500 lb) loading that required about 9 to 10 hours drying time for the blends that were used.

In order to obtain a uniform airflow over all the trays it was necessary to install considerable ducting and baffles between the blower and the tray rack. This diverting of high-velocity air into dead airspace regions was done on a trail and error basis using a pitot tube to measure velocities. Finally an average velocity of 3.66 to 3.90 m per second (12 to 13 ft per second) was achieved over most trays. The air was heated to 99°C (210°F).

The weight of the loaded dryer is about 3636 kg (8000 lb). The cost is about $17 000, broken down as follows: box $7800, dolly $4300, burner $2400 and blower $2300.

The unit is presently in commercial operation at Okanagan Falls, B.C.

Mr. Moyls is a research scientist at Agriculture Canada Research Station, Summerland, B.C.

Genetic changes during 20 years of broiler breeding: A comparison of modern and "vintage" broilers

J.R. Chambers and J.S. Gavora

In the last few years, an increasing number of consumer complaints have been heard about too much fat in broiler chickens. The complaints are about abdominal fat which is the fat around the gizzard and the leaf fat found in the body cavity. This fat represents waste because it is usually removed and discarded before cooking. Fatter broilers need more feed per unit of body weight gain than lean chickens and, when cooking, fatter broiler carcasses need more water and shortening.

This situation prompted the Animal Research Institute of Agriculture Canada in Ottawa to look at the genetic changes in broiler chickens during the last 20 years.

In a recent test, three strains of broiler chicken were hatched, reared and slaughtered at the experimental farm where they had been kept under industrial-like conditions and fed modern broiler rations. One of the strains had been formed from commercial broiler strains in 1958. Since then, this "vintage" strain was kept without selection and was included in the test to represent broilers of 20 years ago. Two broiler stocks purchased from commercial sources represented modern broilers used today by the industry. A comparison of the three groups was made based on growing the broilers to the same age of 47 days. This may not be fair because the "vintage" broilers reach their finished weight much later than 47 days.

The test confirmed the vast improvement in broiler growth rate achieved over the last 20 years. The average dressed carcass weight of the present-day broilers was 1.55 kg (3.4 lb). This was more than twice the dressed carcass weight of the broilers of 20 years ago which had an average weight of .68 kg (1.5 lb). The modern broilers had 38 g (approx 1.3 oz) of abdominal fat which was almost four times as much as in the "vintage" broilers. Relative to the dressed carcass weight, the percentage of abdominal fat was 2.4 percent in the modern broilers and 1.4 percent in the broilers of 20 years ago. In feed efficiency (weight of feed consumed per unit of body weight) the modern broilers did only slightly better than the broilers of 20 years ago. The average figures were 2.0 for the modern broilers and 1.9 for the "vintage" broilers. It is known that

Des tests effectués à l'Institut de recherche animale d'Agriculture Canada confirment que les recherches ont permis de développer une catégorie de poulet à rotir à croissance rapide. Cependant, cette croissance accélérée suppose également une nourriture plus riche qui rend les poulets trop gras pour le goût des consommateurs. Les recherches se poursuivent afin d'établir de nouvelles méthodes de nutrition qui produiront des poulets plus maigres et aideront l'industrie à mettre en marché de la volaille plus adaptée au goût du public.

faster growing chickens use feed more efficiently and that feed efficiency is poor in fatter birds. Apparently, the feed efficiency of the modern broilers was improved more by their faster growth than it was harmed by their greater fatness.

Our test showed that the increase in broiler growth rate over the last 20 years resulted in fatter broilers. Even though the average percentage of abdominal fat from total carcass weight is still rather low (2 percent), the amount of this fat varies from bird to bird and some birds have a much larger proportion of fat in their carcass. Also, the abdominal fat is very visible and this leads to consumer complaints. However, selection for rapid growth must continue in broilers because rapid growth is necessary for efficient meat production. To meet the desires of the consumer and of the poultry industry, selection criteria should seek to develop a fast growing but leaner broiler with good feed efficiency.

Recently, commercial broiler breeding companies moved to include feed efficiency and carcass leanness among the traits for which their broilers are being selected. Poultry research is assisting them by developing new methods for measuring and improving these traits in broiler chickens. This type of research is also under way as a high priority project at the Animal Research Institute in Ottawa.

Drs. Chambers and Gavora are with Agriculture Canada's Animal Research Institute in Ottawa.

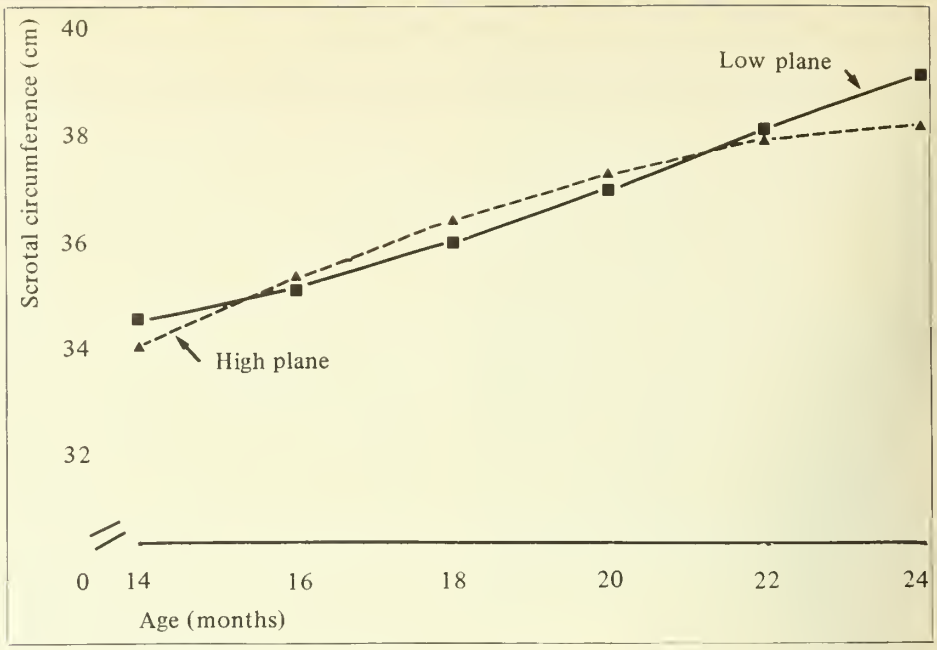


Figure 1. Relationship of scrotal circumference to age from 2-year data in young beef bulls on two planes of dietary energy.

High dietary energy can decrease reproductive performance in young beef bulls

Glenn H. Coulter

Beef breeders, A.I. and stud personnel, and insurance underwriters have suggested that fat, young beef bulls appear to be less fertile than those in so-called "working condition". As a result, the effect of dietary energy intake on the reproductive performance of young beef bulls was studied at the Lethbridge Research Station. Results are now available for 120 Hereford and Angus bulls examined over 3 years.

Bulls were obtained from herds at the Onefour Substation near Manyberries, Alberta. These herds had been established in 1964 when foundation cows were purchased and assigned at random to either a high or low plane of dietary energy line within each of the Hereford and Angus breeds. Replacement males and females were selected within lines based on superior growth performance on one of two planes of dietary energy — either 80 percent ground grain plus 20 percent chopped alfalfa hay (high plane) or chopped alfalfa hay (low plane) fed *ad libitum*. Calves have been run with their dams on shortgrass prairie without supplementation until weaned, when they entered the feedlot for the 168-day growth performance test.

Les jeunes taureaux sont souvent engraissés dans le but d'en faciliter la vente mais ceci peut avoir pour résultat de diminuer leurs performances en matière de reproduction. Les effets des diètes énergétiques sur les capacités de reproduction des jeunes taureaux ont été étudiés à la station de recherche de Lethbridge et sont exposés dans l'article qui suit.

Immediately after the 168-day feedlot test, 10 bulls per line per year were moved to the Lethbridge Research Station as yearlings and continued on the same dietary regimes except for three changes: 1) alfalfa hay cubes replaced the chopped alfalfa hay; 2) rations were limit-fed to produce daily energy intakes of about 150 and 120 kcal digestible energy/kg metabolic weight (metabolic weight = body weight 0.75) for the high and low planes (these energy intakes would be expected to result in daily gains of about 0.9 kg for high plane and 0.6 kg for low plane); and 3) the bulls on the high plane were switched to the low plane at 21 months of age. This reduction in energy intake in the high-plane bulls was introduced to mimic conventional management procedures in which 2-year-old bulls in "show condition" are bought at spring bull sales and then put into "working condition" before being used for natural service or placed in A.I. studs. Evaluation of reproductive potential was measured in the bulls periodically between 1 and 2 years of age.

Most traits characteristic of reproductive capacity were apparently unaffected by high dietary energy intake. No difference in paired testes weight (PTW) (epididymides included) was observed between high (640 g) and low (648 g) planes of

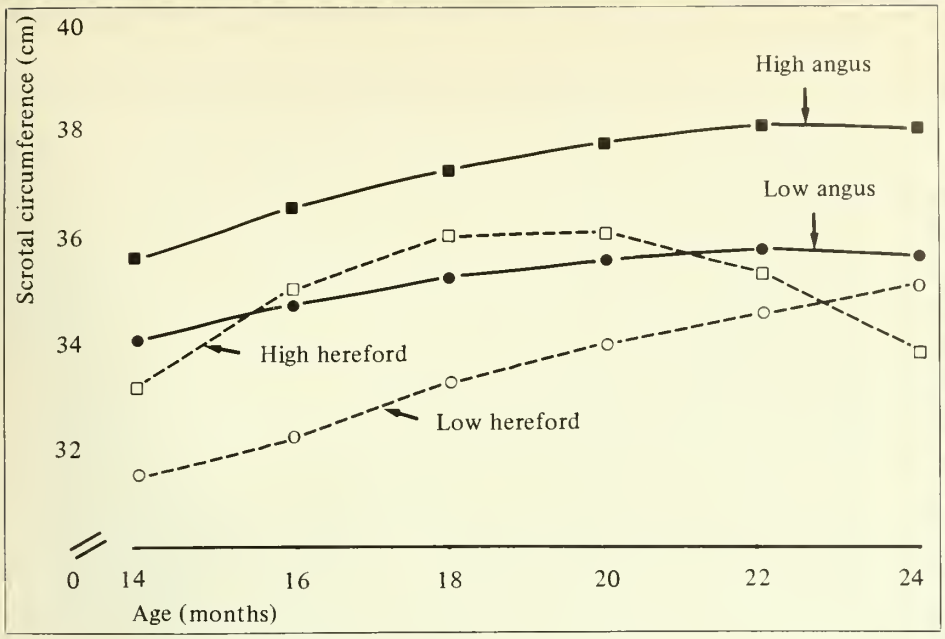


Figure 2. Interaction between breed and dietary energy on scrotal circumference as related to age in young Angus and Hereford bulls.

Dietary energy intake affects the performance of young beef bulls.

TABLE 1. Epididymal sperm reserves per gram of testis (x 10^b ± SE) in 2-year-old beef bulls on two planes of dietary energy

Plane of nutrition	Breed		
	Hereford	Angus	Mean
High	28.1 ± 6.2a	47.1 ± 4.4ab	37.3 ± 4.2
Low	69.2 ± 3.4c	54.7 ± 3.2bc	62.2 ± 2.6
Mean	51.4 ± 5.0	41.5 ± 2.7	51.4 ± 2.9

Between planes of nutrition and between breeds, values followed by different letters differ significantly ($P < 0.01$).

dietary energy; however, a significant ($P < 0.01$) effect of plane of dietary energy on scrotal circumference (SC) was observed. The SC of the high-plane bulls increased initially at a greater rate than the low-plane bulls; however, its growth slowed substantially as the bulls approached 2 years of age. In years one and three, there was no significant interaction of plane of energy by breed (Figure 1); in year two, however, this interaction was highly significant ($P < 0.01$). When scrotal circumferences are plotted against age for both high- and low-plane Hereford and Angus bulls (Figure 2), the rapid increase in SC of the high-plane Herefords followed by a dramatic decrease is most striking. In contrast to the high-plane Herefords, both planes of Angus bulls and the low-plane Herefords showed a progressively decreasing rate of testicular growth through the experimental period.

One aspect of the results that should be of particular concern to the beef industry was the apparent detrimental effect of high-energy diets on the sperm-producing capabilities (as measured by epididymal sperm reserves) of 2-year-old Hereford bulls (Table 1). Epididymal sperm reserves were measured only in years two and three of the study (78 bulls). Hereford bulls fed the high-energy diet had 59 percent lower ($P < 0.01$) epididymal sperm reserves than the Hereford bulls on the low-energy rations. In other words, on the average, high-plane Hereford bulls were producing only half as many sperm as the low-plane bulls. In comparison, the high-plane Angus bulls had 14 percent lower epididymal sperm reserves than the low-plane bulls, although this difference was not significant.

It appears that feeding high-energy diets to young Hereford bulls damages their sperm-producing capability to the extent that several bulls were sterile and the fertility of others was most certainly diminished by the end of the experiment. It is not known whether or not all bulls damaged in this fashion recover, but certainly some do. The rate at which a bull will recover is believed to be related to how fat the bull is and for how long he was in that condition. As only Hereford and Angus bulls were involved in this study, one can only speculate if young bulls of other breeds would be similarly affected. Under many management systems, a long delay between the purchase of a bull and its readiness for breeding may not be tolerable. These results demonstrate the need for an extensive reevaluation of traditional bull management procedures. Seminal quality data from this study are being analyzed.

Regardless of how fat a bull is when purchased, it should be subjected to a thorough evaluation of its reproductive capacity before being turned into the breeding field. To maximize the probability that a bull will be a satisfactory breeder, several aspects of its reproductive potential must be evaluated: these include testicular and scrotal development, ability to breed females, seminal quality and libido.

Dr. Coulter is a reproductive physiologist at the Agriculture Canada Research Station, Lethbridge, Alberta.

Grading eggs for albumen quality

A.T. Hill

With the advent of mass candling, the problem of removing undergrade eggs has become increasingly difficult. In producer egg shipments of mediocre quality it frequently becomes almost impossible for the candler to remove all eggs with undergrade albumens, and many eggs that do qualify soon become Grade B en route to the consumer. Such shipments might better be sampled and, when found deficient in albumen quality, sent directly to the breaker. To implement such a system it is necessary to determine the albumen quality in freshly broken-out eggs, the variability of this quality and its decline during storage.

Les résultats d'une expérience sur la qualité des oeufs effectués à la station de recherche Agassiz d'Agriculture Canada ont démontré les difficultés que l'on peut rencontrer en tentant d'appliquer des standards de niveau de qualité à des éléments tels que l'albumine. Cette qualité, en effet, diminue lorsque le produit est stocké et varie avec l'âge de la poule.

Le présent article suggère l'élargissement des règlements actuellement en vigueur concernant la gradation des oeufs. Un seul exemplaire d'une cargaison pourrait être analysé à la station de gradation des oeufs afin de déterminer si les oeufs sont bons pour la consommation en coquille ou doivent être dirigés vers les casseries.

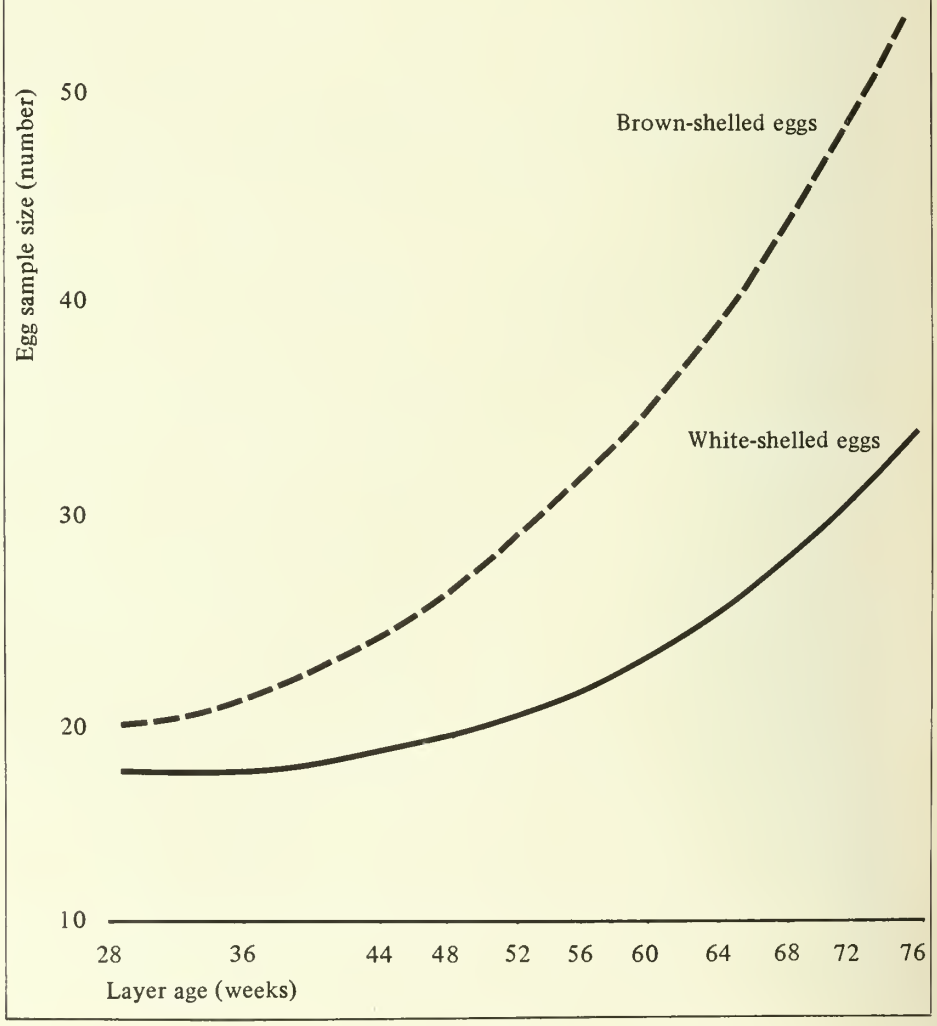
To obtain this information, eggs from eight strains and eleven ages of layers, and five intervals of storage were sampled. Included were six white-shelled strains: Heisdorf and Nelson, Shaver 288, Babcock 300, DeKalb, Hubbard and HiSex; and two brown-shelled strains, Hubbard Comet and the DeKalb Amber Link. These were in use by the industry in 1978. Half the eggs were oiled as laid and the other half non-oiled. Otherwise, the cooling, transportation, washing, drying, grading, storage and the retail store display cooling were typical of egg handling procedures used by the trade. The albumen quality in the broken-out egg was measured in Haugh units.

For eggs broken the day after lay, the Haugh unit results dropped

TABLE 1. Estimated Haugh unit losses in oiled and non-oiled eggs broken 5-26 days after lay and from layers 28-76 weeks of age

Treatment	Age of layers (weeks)	Haugh units on day one	Losses in Haugh units to days			
			5	12	19	26
Oiled	28	89.8	1.8	4.6	7.2	9.4
	36	86.9	1.8	4.7	7.2	9.5
	44	84.4	1.8	4.7	7.3	9.5
	48	83.2	1.8	4.7	7.3	9.6
	52	82.2	1.8	4.7	7.3	9.6
	56	81.3	1.8	4.7	7.3	9.6
	60	80.5	1.8	4.8	7.4	9.7
	64	79.7	1.8	4.8	7.4	9.7
	68	79.1	1.8	4.8	7.4	9.7
	72	78.5	1.8	4.8	7.4	9.8
	76	78.0	1.8	4.8	7.5	9.8
Non-oiled	28	85.4	3.6	8.3	11.0	11.9
	36	84.6	3.8	9.0	12.3	13.6
	44	83.4	4.1	9.8	13.5	15.3
	48	82.6	4.2	10.2	14.1	16.1
	52	81.7	4.4	10.5	14.7	17.0
	56	80.7	4.5	10.9	15.3	17.8
	60	79.6	4.6	11.3	16.0	18.7
	64	78.4	4.8	11.6	16.6	19.5
	68	77.1	4.9	12.0	17.2	20.4
	72	75.7	5.1	12.4	17.8	21.2
	76	74.2	5.2	12.8	18.4	22.1

Graph 1. Estimated egg sample size required to measure haugh units in stored eggs from white- and brown- shelled egg layers 28-76 weeks of age.



approximately one unit for every additional month in age of the layer (Table 1). Lacking the protective covering, the non-oiled eggs declined an average of four extra units in the first day after lay.

Storage losses in oiled eggs varied from 1.8 to 9.8 units, the length of storage being the main factor. Similarly, losses in non-oiled eggs varied from 3.6 to 22.1 units. Length of storage was again an important factor, but age of the layer producing the egg also contributed substantially to these losses. The strain of bird affected albumen quality, but eggs from all strains maintained the same ranking irrespective of the age of the bird laying the egg, the treatment of the egg with or without oil and the duration of storage.

When 67 Haugh units were used as the minimum value for albumen of Grade A eggs, all the non-oiled eggs in the following categories failed to meet the standard (Table 1):

a) eggs stored for 26 days from hens older than 44 weeks;
b) eggs stored for 19 days from hens older than 52 weeks;
c) eggs stored for 12 days from hens older than 68 weeks.

When eggs from layers between 28 and 76 weeks of age were considered on an individual basis, 3 percent of the eggs from hens older than 44 weeks that were graded "A" on day five were below this grade after 12 days in storage, 10 percent of the eggs from hens older than 52 weeks dropped below grade "A" after 19 days, and 19 percent of the eggs from hens older than 68 weeks tested below grade "A" after 26 days. Results from non-oiled eggs were 11 percent for the hens older than 44 weeks, 38 percent for those over 52 weeks and 52 percent for hens older than 68 weeks. For those eggs stored five days, oiled eggs averaged 1 to 23 percent below grade "A" and non-oiled eggs averaged 8 to 76 percent below, with the severity of the undergrades varying directly with the age of the layer.

The egg sample size required to reliably measure Haugh units in white-shelled eggs varied from 16 to 32 eggs, depending on the age of the layer (Graph 1). For brown-shelled eggs it ranged from 19 to 52. It was particularly evident that the sample size rose more rapidly for brown-shelled eggs than for white during the last months of lay (age). Differences in sample size between white- and brown-shelled eggs all resulted from the greater albumen variability of the brown-shelled eggs.

The results of this experiment demonstrate the difficulty in applying fixed grading standards to a characteristic like albumen quality which declines in storage and increases in variability with the increasing age of the layer. This is particularly true since the grading station frequently knows little about the age of layers producing the eggs, the length and condition of storage on the farm or if and when the eggs are oiled. In view of the Canadian Egg Marketing Agency sponsored Gallup study showing that Canadian egg consumers have little if any awareness of what constitutes quality, the present egg grading regulations for albumen quality might well be relaxed. Insofar as albumen quality is concerned, sampling at the grading station to determine if each producer shipment of eggs should go either for consumption in the shell or directly to the breakers would seem all that is necessary.

Dr. Hill is a poultry management specialist, Agriculture Canada Research Station, Agassiz, B.C.

Snow management by swathing at alternate heights

W. Nicholaichuk and
D.W.L. Read

Snow is an important source of water for dryland crops and range plants on the Canadian prairies. Generally, snow constitutes over 25 percent of the total precipitation received. The water equivalent of snow is about 1.36 to 1.95 cm (3½ to 5 in.). Thus, conservation of snow to increase soil water for plant use requires trapping and holding the snow where it is needed, and holding the snowmelt in place until it infiltrates.

La neige est une source d'humidité importante pour les cultures dans les Prairies. L'augmentation de la couche de neige est également essentielle pour la culture sur chaume.

Durant les sept dernières années, la station de recherche de Swift Current a étudié les façons d'utiliser la neige en andainant les chaumes à différentes hauteurs ce qui a pour effet d'augmenter et d'améliorer la culture.

For the past 7 years, the Swift Current Research Station has conducted a study on the management of snow by swathing at alternate heights. Snowfall on the Canadian prairies is usually accompanied by winds of a blizzard intensity. Thus snow usually drifts until it is deposited on the lee side of wind barriers like field wind breaks, grass stalks and standing stubble, etc. Very simply, to manage snow under continental climatic conditions necessitates managing the wind.

Four uniform plots ranging in size from 4 to 4.8 ha (10 to 12 acres), which were in a 2-year rotation of spring wheat and summer fallow, were used in the study. One swathing treatment consisted of alternately swathing the wheat crop at two different heights using a self-propelled swather. The stubble height depended on the crop stand conditions (Table 1). The other plot was swathed at a uniform height.

Standard meteorological snow survey procedures were used to determine the snowpack accumulation in the two treatments. Gravimetric soil moisture samples on each treatment were taken to determine the soil moisture content in the fall and following spring.

The average depth of snow in the alternate height stubble was 23 cm, compared to 20 cm for the uniform stubble (Table 1). The average difference in the water equivalent of the trapped snow was 1.7 cm. A maximum difference in equivalent moisture of the snowpacks in the two treatments was 4.2 cm in the year 1973-74. Generally, the water equivalent of the snow in the alternate height stubble was greater than that in the uniform stubble. The snow tended to accumulate to a higher density in the short stubble than within the tall stubble of the alternate height treatment. The density of snow within the tall stubble was approximately the same as within the uniformly swathed plots.

To what extent was the trapped snow stored in the soil? The average increase in moisture stored in the soil profile by swathing at alternate

Snow management by swathing at alternate heights.

heights was 1.4 cm which represents a 30 percent increase (Table 2). The increase in the amount of moisture conserved ranged from a minimum of 0.4 to a maximum of 5.2 cm. A similar observation made on a large farm-scale trial near Swift Current in 1977-78 indicated the amount of soil moisture available by the system of snow management was 2 cm.

Based on long-term studies at the Swift Current Research Station, it is generally accepted that 8 cm or more of reserve moisture is required to produce a crop of 14 bushels on stubble land. With an improved stubble management system for moisture conservation, the average available water in the spring over the 7-year period was 8.2 cm. If 8 cm of available water is considered the criterion for seeding stubble, then stubble could have been seeded in 4 of the 7 years if this practice was followed, compared to 2 out of 7 years without some form of snow trapping if the conventional method of swathing was used.

Based on snow surveys, approximately 92 percent of the trapped snow is stored as soil moisture. From year to year, the amount stored in the profile appears to be linearly related to the amount of snow potentially available. However, trapping additional snow does not always guarantee that more water is available for plant use. Hydrologic studies at Swift Current have shown that the occurrence of late fall rains often increases the runoff potential, depending on springmelt conditions. As a result, there may be years in which swathing at alternate heights may not be of benefit.

An important point to bear in mind when considering this type of management is that if the method proves successful, the resultant stored moisture should be utilized for growing a crop. Otherwise, there is the risk of contributing to the ever-increasing problem of dryland salinity.

Dr. Nicholaichuk and Mr. Read are research scientists at Agriculture Canada Swift Current Research Station.

TABLE 1. Snowfall and snow accumulation on the uniform and nonuniform stubble system of snow management (1971-79) (cm)

	Uniform stubble				Nonuniform stubble		
Year	Snow-fall	Stubble height	Av snow depth	Equiv. moisture	Stubble height	Av snow depth	Equiv. moisture
1972-73	12.6	28	8	1.3	30 & 13	9	1.6
73-74	19.4	15	30	7.7	23 & 15	37	11.9
74-75	12.6	15	22	5.4	23 & 13	27	5.3
75-76	14.5	15	19	5.3	15 & 8	18	4.5
76-77	6.0	25	14	3.0	25 & 13	16	4.0
77-78	12.7	31	21	6.0	31 & 15	31	9.8
78-79	18.8	23	29	6.8	31 & 13	30	8.5
	Average		20	5.0		23	6.7

Mean difference in equivalent moisture = 1.7 cm (significantly different at 2.5% level)

TABLE 2. Available soil moisture (0-120 cm depth) as affected by snow management practices (1972-79) (cm)

	Uniform stubble			Nonuniform stubble		
Year	Fall	Spring	Difference	Fall	Spring	Difference
1972-73	4.39	7.96	3.57	3.10	9.40	6.30
73-74	-.41	7.04	7.45	-1.63	6.52	8.15
74-75	4.82	9.09	4.27	4.06	8.74	4.68
75-76	4.35	5.48	1.13	3.42	5.88	2.46
76-77	3.98*	7.12*	4.14*	-0.77	10.51	4.52
77-78	.15	6.08	5.93	-1.40	9.72	11.12
	0.60**	5.50**	4.90**	3.98**	10.96**	6.98**
78-79	1.03	7.24	6.21	0.93	6.40	5.47
	Average		4.67			6.00

Mean difference in available moisture = 1.43 (significant at the 5% level)

* estimated from adjacent rotation studies on South Farm

**large field-scale private farm observations near Swift Current

ECHOES/ECHOS
from the field and lab / des labos et d'ailleurs

The influence of Turkey Red Turkey Red occupies the same important place in winter wheat breeding as Marquis does for spring wheat breeding. We owe much to the Russian Mennonites who brought this remarkable wheat to North America 106 years ago.

The lineage of the winter wheat varieties released by the Lethbridge Research Station can be traced back to Turkey Red. Winalta is a cross between Minter and Wichita, both of which have Turkey wheat in their parentage. Sundance is a cross between Kharkov 22 MC and Cheyenne, both of which are selections from Turkey types. The parents of Norstar are Winalta and Alabaskaya, with the effect of Turkey Red coming from the Winalta side.

Turkey Red had many other names including Red Russian, Alberta Red, Kharkof, Crimean, and Malakof. Many selections were made from the Turkey types, and one of them was Kharkov 22 MC. This variety was grown for many years in Alberta because of its superior level of winterhardiness. Unfortunately, Kharkov 22 MC was very susceptible to shattering and did not produce a good quality flour for bread.

A big change took place in 1961 with the licensing of Winalta. Its flour quality was much superior to the older varieties. It was earlier in maturity and more resistant to shattering than Kharkov 22 MC, but not as winterhardy. Winalta soon took over most of the winter wheat area in Alberta and Montana.

In 1971 the variety Sundance was released from Lethbridge. This variety was superior to Winalta in yielding ability and winterhardiness, but was slightly later maturing and not equal to Winalta in bread-making

properties. Sundance became popular in southern Alberta, but never caught on in Montana where they prized very highly the flour properties of Winalta.

Norstar was released in 1977. This variety combined the three important characteristics of high yielding ability, good flour quality, and superior winterhardiness. Norstar is expected to become the predominant variety in western Canada.

Dr. M.N. Grant
Weekly Letter
Agriculture Canada Research Station
Lethbridge, Alberta

The fuzzless peach Canadians are acquiring a taste for nectarines but demand is met largely by imports because these fuzzless peaches are not well adapted to Canada's climate.

Dr. R.E.C. Layne, a plant breeder at Agriculture Canada's Harrow, Ont., Research Station, is trying to overcome this problem by breeding new nectarine varieties suited to the Canadian climate.

There is some nectarine production in southern Ontario today. But it is limited because the varieties with consumer appeal are not really cold-hardy or disease-resistant enough for growing in Canada.

That's why Dr. Layne decided to expand his nectarine breeding program.

In the 1960s, crosses were made at Harrow among the best eastern varieties, and new cultivars were introduced in 1974 named Harko and Hardired.

These introductions were then crossed to the best of the California varieties to improve fruit size and quality while retaining the superior cold hardiness and disease resistance of the Canadian stock. Final selections from these crosses are now being sent to growers for trials. From these trials should come new nectarine varieties to help expand production in southern Ontario.

Expert committee on vertebrate pests A new expert committee has been formed to study the problem of bird and animal damage to agricultural crops.

Crop losses to vertebrate pests, such as the red-wing blackbird, can be extensive every year. And controlling these pests can be more difficult than dealing with insects and weeds.

The committee, made up of representatives from both agriculture and wildlife services, will look for effective ways to reduce the damage.

The Food Connection (A film produced for Agriculture Canada by the film board and Crawley Films Limited, being distributed by the National Film Board of Canada.) One in every four jobs in Canada is related to food. Close to 75 million meals are served in Canada every day. Food makes up 12 percent of Canada's exports but only 10 percent of the land is under cultivation. These are some of the facts gleaned from *The Food Connection*, a film about the agricultural industry in Canada and the role played by Agriculture Canada.

This federal department's activities extend into many areas: programs and policies drawn up by senior officers; exchanges with foreign countries; research; the inspection, grading and control of meat and produce; inoculations; control of pests; and many others. The whole agricultural industry relies heavily on the department's research laboratories.

The film gives the audience a broad view of the many stages involved in the production of food, from the field to the canning factory, and from the barn to the packing plant, with a side trip to a laboratory. Cows on the hoof are succeeded by pigs on the hook hanging inside a packing plant where government inspectors, under the supervision of a federal veterinarian, carefully check each carcass. Huge refrigerating vans roll produce across hundreds of miles to where the markets are. A spectacular shot atop a supertanker shows grain shooting through a pipe into the hold almost as if it were sand.

The camera sweeps over lush fields and fruit-laden orchards reminding us that, in spite of all the technology, widescale mechanization and modern marketing methods which have streamlined the industry, the essential link in the food chain still remains the soil.

Everyone has to eat, and what we eat has been subjected to rigid government standards for our personal health and safety. *The Food Connection* explains the diversified role played by Agriculture Canada, and how its activities affect every Canadian every day.

Grain sorghum management project approved Agriculture Canada and 20 farmers from the Alberta Corn Committee are cooperating on a project to study the management of grain sorghum crops in southern Alberta.

The 2-year study is being partly funded by the federal department's New Crop Development Fund. Earlier studies have shown that sorghum has good potential as a new crop for the dry, warm areas of southern Alberta. It provides a nutritious livestock feed and can also be distilled for alcohol.

Dr. Dick Lane checks seedlings of new nectarine varieties.

Dr. D.G. Dorrell became Director of the Winnipeg Research Station in 1980. *See page 4.*

Agriculture Canada Research Station, Delhi, Ontario

The research station at Delhi was established in 1933 to provide growers with information and guidance on the production of flue-cured tobacco in Ontario. Approximately 70 percent of the flue-cured tobacco produced in Canada is grown within 40 km of the research station. The station has 60 ha of Fox loamy sand type soil.

Throughout the years flue-cured tobacco has become increasingly important in Ontario agriculture, and in 1980 total production was 102 500 t from 40 000 ha with a gross farm value of $308 million. Approximately one-third of the crop is exported to more than 50 countries throughout the world. The crop in Ontario is being produced in the northernmost fringes of the tobacco-growing regions.

Research being conducted falls under three main areas: crop production, crop protection and tobacco and health.

Research in crop production is focused mainly on the development of better varieties; seedling and field production methods; fertilizing techniques; and improved cultural, harvesting and curing practices.

The overall objective of crop protection research is to minimize pest damage and pesticide residues. The uncertain status of pesticides because of environmental, consumer, or user hazards requires the constant evaluation of new chemicals for the control of disease, insects, nematodes, weeds and suckers.

The overall research approach for improving the quality of flue-cured tobacco has also included improvements from a health standpoint. In 1973 a Tobacco and Health program was officially initiated at the Delhi Research Station as a cooperative effort between Agriculture Canada and Health and Welfare Canada.

La station de recherche d'Agriculture Canada, Delhi, Ont.

La Station de recherche de Delhi a été établie pour offrir aux cultivateurs des informations et lignes directrices sur la production de tabac jaune en Ontario. Près de 70 pour cent de la production de tabac jaune canadienne est cultivée dans un rayon de 40 km de la station de recherche qui dispose de 60 hectares de sol sableux loameux.

Au fil des années, le tabac jaune est devenu de plus en plus important parmi les produits cultivés en Ontario. En 1980, la production totale était de 102.500 tonnes pour 40.000 hectares et représentait la somme de $308 millions. Un tiers de cette culture est exportée vers plus de 50 pays du monde. En Ontario, la culture est produite dans la zone la plus septentrionale des régions où le tabac est cultivé.

Les recherches entreprises dans ce domaine entrent dans trois catégories: production, protection des cultures, et le tabac et la santé.

Les recherches en matière de production sont centrées principalement sur le développement de meilleures variétés; plantules et méthodes de production; techniques de fertilisation; améliorations des cultures et des récoltes.

L'objectif global des recherches dans le domaine de la protection des récoltes est de diminuer les dommages causés par la peste et par l'effet des résidus des pesticides. Le statut incertain de ces pesticides exige une évaluation constante des nouveaux produits chimiques destinés au contrôle des maladies, à la lutte contre les insectes, les nématodes et les mauvaises herbes.

Les recherches générales en vue d'améliorer la qualité du tabac ont été reliées à la question de la santé. En 1973, un programme tabac et santé était mis sur pied à la station de recherche de Delhi en coopération avec Agriculture Canada et le ministère de la Santé et du Bien-être.

Top photo. Photo du haut.
Dr. Frank Marks, Director.
M. Frank Marks, directeur.

Middle photo. Photo du milieu.
Replanting tobacco after the spring frost, 1980.
Replantation du tabac à la suite d'une gelée printanière, 1980.

Bottom photo. Photo du bas.
Experimental tobacco field.
Champ de tabac expérimental.